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BY THE AUTHOR.

PREFACE.

The non-existence of any work in the English language on the treatment of Club-foot and analogous distortions by division of tendons, may perhaps plead the apology for the appearance of this Treatise. The importance of the subject has been rapidly engrossing the attention of the profession, from the valuable publications of Stromeyer, the numerous reports of the labours of other surgeons which have appeared in the continental periodicals, the recent discussions in the medical societies of this metropolis, and more particularly from the announcement in our medical journals of several successful cases treated by this method. Having in January 1837 published a Dissertation* on this subject, and having since possessed ample opportunities of confirming the accuracy of nearly the whole of the opinions then entertained, I venture to hope that this work will be useful in promoting the study and improving the treatment of a class of affections which, until within the last three years, has been to a considerable extent confined to the care of the instrument-maker. At an early period of my medical studies, I devoted much attention to the nature of these distortions, from the

* "Symbolæ ad Talipedem Varum cognoscendum."

circumstance of my being afflicted with Talipes in the left foot; and although I consulted the most approved surgical authorities, and many members of the profession in the metropolis, from none did I receive the slightest prospect of cure, and was compelled to be content with the assistance afforded by wearing mechanical instruments. Being particularly desirous of obtaining information respecting the anatomical condition of the limb, and finding the preparations in museums, as well as the published materials, extremely insufficient, my inquiries were diligently directed to the attainment of further information on the anatomy of the subject. I obtained, however, only the most discouraging opinions; the affection having invariably been attributed to malformation and ankylosis of the individual bones of the tarsus, the muscular contraction having been regarded as secondary.

In the year 1832 I learned, from Cruveilhier's "Anatomie Pathologique," that Delpech had proposed, and actually carried into effect, the division of the tendo Achillis. I anxiously perused the "Chirurgie Clinique" (1823) of the latter; and having become thoroughly convinced of the feasibility of his plan, I again consulted my professional friends, who respectively dissuaded me from submitting to the operation, being of opinion that inflammation and diffuse suppuration, with exfoliation of the tendon, would probably occur; that malformation of the bones certainly existed; and that, were the operation practicable with safety, it was doubtful whether, after

division of the tendo Achillis, the astragalus could be replaced beneath the axis of the tibia; and, moreover, that even should the heel be depressed, ankylosis of the ankle would in all probability take place. These objections did not satisfy me of the impropriety of the operation; but my confidence was greatly diminished by discovering that Delpech, in his second work ("L'Orthomorphie," 1829), published six years afterwards, had narrated the same case, without announcing any repetition of the operation. Notwithstanding that the arguments against the operation adduced by the Parisian journals did not appear well founded, I reluctantly followed the advice of my friends, and relinquished the project of obtaining relief by this means.

In the year 1834, I was much gratified by learning, from the "Archives générales de Médecine," that Dr. Stromeyer of Hanover had proposed some very important modifications of the plan of Delpech, and had successfully operated two cases. A perusal of the reports satisfied me of their resemblance to my own lameness, and led me to the resolution of proceeding to the Continent. In 1835 and the spring of 1836 I visited Leyden, Leipsic, Dresden, and Berlin; and in these cities formed the acquaintance of several distinguished anatomists and surgeons, from most of whom, in answer to my inquiries respecting the operation of division of the tendo Achillis, I still experienced only disappointment. But Professors J. Müller and R. Froriep appeared to investigate the foot entirely with reference to its individual ana-

tomical and morbid characters, discarding the notions of the necessary dependence of these distortions on malformation of the bones, as well as the danger of wounding tendons. Professor Müller, in reply to the question of the propriety of the operation as deduced from the anatomical condition, was of opinion that no improper conformation of the bones existed calculated to impede the replacement of the foot. Professor Froriep considered that the method pursued by Dr. Stromeyer was based on sound surgical principles; that the report of his cases denoted the possession of great talents and indefatigable perseverance; and that the performance of the operation was consequently advisable. Having thus been strengthened by the judgment of these eminent professors of the university of Berlin, I determined on placing myself under the care of Dr. Stromeyer; and to his skill and kindness I am indebted for the restoration of my foot.*

This exposition of the circumstances which induced me to study this class of diseases may, perhaps, be considered an unnecessary intrusion; but as it serves to illustrate the prevalence of the belief in the incurability of distortions which had existed for any considerable length of time, the want of general information respecting their anatomy and pathology, and the opinion of the danger of dividing large tendons, I trust it will not be entirely destitute of utility. It will likewise explain the reason of a

* Dr. Stromeyer has since been appointed Professor of Surgery in the University of Erlangen.

physician deviating from custom by the performance of a surgical operation.

Through the liberality of Dr. Stromeyer, I was afforded the opportunity of practising this operation in Hanover, July 1836. Subsequently at Berlin, in conjunction with Professor Dieffenbach,* who, on my return to that city, adopted this operation with the whole ardour of his genius, I treated upwards of thirty patients affected with various gradations of Club-foot. I am also indebted to Professor Müller for having placed at my disposal for dissection the numerous collection of fœtuses affected with distortion, contained in the Berlin Museum.

The Stromeyerian method of cure had not been practised in this country until the performance of the operation by me in London, Feb. 20, 1837.† I had supposed myself (see pp. 79, 80) the first British practitioner who had effected division of the tendo Achillis; but I have since learned that Mr. Whipple performed the operation, according to the method pursued by M. Bouvier of Paris, as early as May 1836; I have therefore to congratulate him on the precedence. But although I cordially admit the merit due to that gentleman in having been the first in this country to resort to *any* operation for the radical cure of this distressing deformity, I must, nevertheless, respectfully contend for the distinction of having introduced the Stromeyerian method of

* This surgeon, so justly celebrated for the dexterity of his operations, has since this period divided the tendo Achillis in upwards of 150 cases of distorted feet.

† The case is detailed p. 194 in this Treatise.

cure, which, for reasons hereafter detailed, will in all probability be universally followed. The method of M. Bouvier, however safe and successful in a small proportion of cases, is totally inapplicable in the more severe cases, which are very numerous.

I have had the gratification of communicating the details of the Stromeyerian method to at least fifty surgeons,—amongst others, Sir Astley P. Cooper, Bart., Sir P. Crampton, Bart., Mr. Andrews, Mr. Key, Mr. Guthrie, Mr. B. Cooper, Mr. Tyrrell, Mr. Attenburrow (of Nottingham), Mr. South, Mr. Solly, &c.; —from whose exertions a still more extensive diffusion of this method may be anticipated. Since the first publication of Stromeyer on the subject, several hundred cases have been operated in various parts of the Continent. I have already treated eighty-two cases (nine of which have been members of families of medical men), some requiring division of the tendo Achillis only, others that of two or more tendons. The total number successfully operated by different surgeons in various parts of the United Kingdom may have been still larger; so that the repute of this method, as a perfectly safe operation, and one of the greatest utility, may be regarded as firmly established.

The principal part of the materials for this Treatise has been long accumulated, and was originally destined to constitute a portion of a general work on the deformities of the human frame arising from paralysis or spasm, the composition of which was commenced eighteen months since. But I have been induced to

deviate from this plan, from the daily addition to my observations, the increasing demand for information on division of tendons, and the conviction that, instead of attempting a systematic treatise on deformities in general, during the infancy of this method, the endeavour to lay the groundwork by publishing, in the form of a monograph, the facts and observations on Club-foot and analogous distortions, would at the present period be more acceptable to the profession. In accordance with this principle, and with a view to the practical illustration of the subject, I have in the following pages devoted less space to the Treatise itself than to the Cases and accompanying Remarks. I have endeavoured, both in the history of the Cases and the Engravings to follow nature as accurately as possible. Many of the drawings have been executed by myself, and the remainder under my immediate inspection.

I have occasionally resorted to other kinds of apparatus than those represented, but can confidently recommend the latter as competent, after the necessary operation, to remedy every curable case of distortion of the foot. One instance only of deformity (figs. 5 and 6) I have not undertaken to cure, on account of the advanced age of the patient, and the injury inflicted on the tarsal bones by continued exercise. I have, however, at present under my care a patient aged 16, the grade of whose deformity precisely resembles that represented in these figures; in whom I entertain sanguine hopes of success from division of the plantar fascia, and the contracted

muscles of the great toe in the sole, in addition to the extensors and adductors of the foot.

In the classification of the varieties of distortions of the feet depending on contraction of certain muscles (p. 2), I have included in the genus Talipes three species only, not having witnessed, prior to that part of the Treatise passing through the press, the fourth species, Talipes calcaneus, described in Case XXXV.

Finsbury Square,
April 1839.

CONTENTS.

INTRODUCTION.

Summary of opinions entertained respecting the morbid anatomy of Club-foot or Talipes; necessity of the study of the subject in infantile cases; classification of opinions, page ix. Glisson, Camper, Blumenbach, Naumburg, Wanzel, Brückner, Scarpa, Jörg, Clossius, Colles, Mackeever, Palletta, Delpech, Cruveilhier, Löb, Tourtual, reviewed and compared with the opinions of the author, x-xviii. Summary of the investigations into the causes of Talipes; Hippocrates, Glisson, Camper, B. Bell, Duverney, Boyer, Scarpa, Jörg, Rudolphi, Delpech, Cruveilhier, Tourtual, P. von Walther, Stromeyer; analogy of Club-hand, xix-xlvi. Little improvement in treatment from Hippocrates until the latter part of the last century; discovery of an operation for the cure of Talipes by Thilenius; methods of operation subsequently adopted by Sartorius, Michälis, Delpech; rules laid down by Delpech; importance of the re-introduction of the operation by Stromeyer; description of his manner of dividing tendons in general, and the principles which he recommends; frequent repetition of the operation since Stromeyer; few improvements since effected in the treatment; estimate of the labours of Stromeyer, xlvii-lxii.

ON CLUB-FOOT AND ANALOGOUS DISTORTIONS.

Definition of the varieties of Club-foot — Talipes equinus, Talipes varus, and Talipes valgus,* page 2. Symptoms of T. equinus, 3. Symptoms of T. varus, 3. Symptoms of T. valgus, 4. General condition of the limb, and mode of progression in Talipes, 7. Complication, 8-10. Morbid anatomy of Talipes, 11-14. Pathology of Talipes; monstrosity; arrêt de développement; influence of the imagination of the mother on the production of congenital Club-foot; influence of external injury on the fœtus; existence of non-congenital Club-foot; origin during the process of dentition; production from paralysis, or from spasm; hysterical Talipes; disturbance of the reflex functions of the nervous system; analogous contraction in the hand — Club-hand; contraction in the leg from abscesses, and sloughing; from long-continued confinement; from acci-

* See also the Preface, p. xiv., and Case XXXV. p. 263.

dental rupture of the tendo Achillis; simultaneous existence of deformity in the hands and feet; co-existence with strabismus and psellismus, 15-25. Treatment of Talipes, medical, surgical, and mechanical, 26, 27. Division of contracted tendons; principles followed by Stromeyer, 28. Explanation of the safety of dividing large tendons, 29. Manner of dividing the tendo Achillis pursued by the author, 30. Division of the tendons of posterior tibial, anterior tibial, and flexor longus pollicis muscles, 31. The extension foot-board of Stromeyer, 32. Scarpa's instrument, as modified by Stromeyer and the author, 34. Treatment after operation, 35. Apparatus for T. valgus, 37. Length of time occupied in the cure of Talipes, 38.

APPENDIX.

Case I.—Non-congenital Talipes equinus, from paralysis of the anterior tibial muscle; consequent contraction of the gastrocnemii, and other posterior muscles of the leg, from absence of the action of their antagonists for fourteen years. Cured by division of tendo Achillis, 40-44.

Remarks.—Cause of the disproportionate breadth of the front-part of the foot; cause of the twitching sensations in the gastrocnemii after operation, 45. Necessity of support to the ankle; mode of remedying unnatural arch of the tarsus, 46.

Case II.—Congenital Talipes equinus, from spasmodic contraction of muscles of the calf, of fourteen years' duration. Cured by division of tendo Achillis, 47-51.

Remarks.—Comparison of congenital T. equinus with the non-congenital form, 52. Structural shortening; co-existence of contraction in posterior tibial and long flexor muscles of the toes, with that of gastrocnemii; necessity of studying these distortions in their physiological and pathological relation, and not solely in a mechanical point of view, 53. Relative difficulty experienced in effecting mechanical elongation of spasmodic contraction; spasmodic contraction combined with structural shortening; contraction from paralysis of antagonists, whether combined with structural shortening or not, 54. Atrophy and adipose degeneration of muscular fibre, 55. Recovery of power in the divided muscles; explanation, 56.

Case III. — Non-congenital T. equinus, from paralysis, cured by division of the tendo Achillis, 57-63.

Remarks.—Indications of cure, 64. Necessity of great attention during the mechanical part of the cure; propriety of mechanical support to the limb greater when the distortion has arisen from paralysis, 65. Cessation of symptomatic elevation of pelvis and curvature of spine after the operation, 66.

Case IV.—Non-congenital T. equinus, from paralysis. Cure of the deformity by division of the tendo Achillis, after having existed twenty-nine years, 67, 68.

Remarks.—Removal of deformity sometimes more easily effected than the cure of lameness, 69. Deformity resulting from paralysis gradually supervenes; explanation of the occurrence of deformity, in consequence of paralysis; distortion takes place towards that side where the greater mass of muscles is situated, 70. Manner of preventing the occurrence of deformity when paralysis exists, 71. Application of mechanical instruments does not necessarily produce emaciation of the limb, 72. Congenital Talipes never the result of paralysis, 74. Resemblance of this foot to Talipes valgus after the operation, 75.

Case V.—Congenital T. equinus, from spasmodic contraction of gastrocnemii. Cured by division of tendo Achillis, after thirty-five years' duration of the distortion, 76, 77.

Remarks.—Slight distortion productive of great pain and fatigue in walking, 78. Remarkable circumstance of the patient having, many years since, divided his tendo Achillis for the cure of the lameness, 78.

Case VI.—Congenital T. equinus, from spasmodic contraction of the muscles of the calf. Cured by division of the tendo Achillis, 81-85.

Remarks.—Degree of deformity does not solely determine the difficulty of the case, 86. The degree of pain experienced after the operation depends on the degree of elongation of ligaments necessary, 87. Resistance of muscles not divided; disadvantage in entirely discontinuing mechanical extension at night, 88, 89. Comparison of the pain experienced with rheumatic pain, 91.

Case VII.—Non-congenital Talipes equinus, arising from spasmodic contraction of the extensor muscles of the foot. Cured by division of the tendo Achillis, the tendon of the flexor longus pollicis and the extensor proprius pollicis, 92.

Remarks.—The reasons for division of the different tendons; proposition to divide posterior tibial and peronei tendons for the cure of T. equinus, although not primarily contracted; manner of effecting division of the flexor longus and extensor proprius pollicis muscles; origin of the distortion considered; a common cause in children, 100.

Case VIII.—Talipes varus previously partially cured by the application of instruments. Cured by division of the tendo Achillis and tendon of the tibialis posticus muscle, 105.

Remarks.—The amount of benefit easily obtainable by mechanical means; reasons for the treatment adopted in this case, 109.

Case IX.—Congenital Talipes equinus, combined with bending of the knee and an imperfection in the motions of the hip, affecting the right extremity; similar affection on the left side, but in a slight degree; congenital inward squinting of the right eye; origin—disturbance of the development and functions of the central organs of the nervous system during fœtal existence; consequent spasmodic contraction of the gastrocnemii, semi-membranosus, semi-tendinosus, biceps femoris (probably also of the psoas and iliacus internus) muscles, and rectus internus of the right eye; treatment of the T. equinus by division of the tendo Achillis; the cure of the bending of the knee being effected by the same operation and subsequent mechanical extension, 114.

Remarks.—Co-existence of spasmodic contraction in various parts of the body considered; explanation of the cause; difficulty attending diagnosis and prognosis of cases wherein numerous contractures exist, 118.

Case X.—Deformity of the ankle, resembling in external characters Talipes equinus; false ankylosis of the ankle in the extended position; shortening of the gastrocnemii and other posterior muscles of the leg, induced by the cicatrisation of extensive abscesses, which had extended in various directions among the muscles on the posterior part of the leg, accompanied by caries of the bones, particularly of the tibia. Cured by division of the tendo Achillis, 123.

Remarks.—Indications of cure; this case instructive in the study of the ætiology of Talipes, 129.

Case XI.—Deformity of the ankle, resembling Talipes in external characters; false ankylosis of the ankle in the extended position; contraction of the gastrocnemii, and other so-called extensors, from abscesses in the back of the leg, and necrosis at different parts of the tibia and fibula, principally of the latter bone. Cured by division of the tendo Achillis, 130.

Remarks.—Comparative utility of the mechanical and surgical methods of treating these distortions; resemblance between this and preceding case. Importance of the circumstance of perfect recovery of volition in all the muscles; division of tendo Achillis does not produce the debility of the gastrocnemii occasionally witnessed, 135.

Case XII.—Talipes equinus acquisitus, converted by constant exercise into a deformity resembling in external appearance Talipes varus; cause, spasmodic contraction of the gastrocnemii. Cured by division of the tendo Achillis, 142.

Case XIII.—Talipes varus congenitus, affecting both limbs. Remote cause—severe derangement of the supply of motor and nutrient nervous energy to the lower extremities; proximate cause—spasmodic contraction

and structural shortening of the adductor and so-called extensors of the foot. Cured by division of the tendo Achillis in both feet, 148.

Remarks.—Restoration of the muscles incomplete in very severe cases of T. varus, but operation beneficial by producing two efficient passive organs of locomotion, 152.

Case XIV.—Talipes varus acquisitus. Non-congenital Club-foot of the right side, depending on spasmodic contraction of the gastrocnemii and other posterior muscles of the leg, and more particularly of the muscles of the sole. Cured by division of the tendo Achillis, and tendon of the flexor longus pollicis muscle, 153.

Remarks.—Frequency of the existence of a similar affection in both feet when one only is made the subject of complaint, 155.

Case XV.—Talipes varus congenitus. Congenital Club-foot of the left side. Cured by division of the tendo Achillis, 156.

Remarks.—On the small degree of benefit frequently attainable by means of instruments, 158.

Case XVI.—Talipes varus congenitus. Congenital Club-foot affecting both extremities; cause—spasmodic contraction, with structural shortening of the extensors and adductors of the feet. Cured by division of the Achilles tendons, 159.

Case XVII.—Talipes varus congenitus. Congenital Club-foot of both extremities. Origin—spasm and structural shortening of the extensors and adductors of the feet. The right foot cured by division of the tendo Achillis and the tendon of the posterior tibial muscle; the left, by division of the tendo Achillis only, 164.

Remarks.—Explanation of the necessity for the application of instruments after the operation in infantile cases, 168. Utility of division of posterior tibial tendon considered; seven other infantile cases cured by operation, 169. Importance of guarding against the application of unnecessary pressure with instruments; the direct benefit, or removal of the deformity, quickly results from the operation; but the indirect benefit, the obtainment of muscular power, less rapid; difference between the *extent* of the distortion and the *severity* of the affection of the nerves and muscles by which it is produced. Observations on the treatment of infantile cases in general, 171. The prospect of cure without operation, 172. Ordeal hitherto undergone by individuals affected with Talipes, 173. The most favourable period for division of tendons in infantile cases considered, 175. Plan of treatment recommended in infants under the age of six months, 176. Description of apparatus adapted to this period, 177. Apparatus requisite at a later period, 178. Manner of applying it, 179. Necessity of very gradual progress with the mechanical treatment, 180. Period

when operation becomes necessary, 181. Treatment by plaster of Paris, or by the immovable apparatus.

Case XVIII.—Talipes varus congenitus. Congenital Club-foot in both extremities, from spastic contraction of the extensor and adductor muscles. Cure of the deformity of the right foot by division of the tendo Achillis, and of the left by division of the tendo Achillis and tendons of the anterior and posterior tibial muscles, 182. Description of a modification of the apparatus of Stromeyer, 184.

Case XIX.—Talipes varus congenitus. Congenital Club-foot affecting both limbs, from the same cause as Case XVIII. Cured by division of the Achilles tendons, 186.

Case XX.—Talipes varus acquisitus. Distortion of both feet, resembling in external appearance congenital Club-foot, produced in the left foot by paralysis of the anterior muscles of the leg, and in the right by spasmodic contraction of the posterior muscles. The deformity cured by division of the Achilles tendons, 190.

Remarks on Cases XVIII., XIX., XX.; their external resemblance, although affording instances of T. varus varying in its nature in three respects, 192; earliness of the stage of embryo development at which Talipes is produced, 193. Doubts of the production of congenital Talipes from paralysis.

Case XXI.—Talipes varus acquisitus. Non-congenital distortion (Club-foot) from permanent spasmodic contraction of the extensors and adductors of the left foot; similar aberration in certain muscles of the left arm. Cure of the deformity of the foot by division of the tendo Achillis, 194.

Remarks.—Comparison of the state of the foot both before and after the cure of the distortion, 198.

Case XXII.—Talipes varus acquisitus. Distortion resembling the highest grade of congenital Club-foot, arising from non-congenital permanent extension of the ankle-joint; the remote cause being paralysis of the anterior muscles of the leg, and the proximate cause permanent contraction of the gastrocnemii and other posterior muscles from the absence of antagonists. Cured by division of the tendo Achillis only, 200.

Remarks.—Reasons for performance of division of tendo Achillis only, 206. The state of volition after the operation considered; description of a similar case successfully operated, 207. Influence of the act of walking in augmenting distortion; great degree of atrophy resulting from paralysis, 208.

Case XXIII.—Talipes varus congenitus. Congenital Club-foot of the

highest degree of deformity. Cured by division of the tendo Achillis and tendons of the anterior and posterior tibial muscles, 209. Description of an apparatus occasionally applicable in the reduction of the severest grade of T. varus, 213.

Remarks.—Reasons for undertaking the treatment of so severe a case, 218. Comparison between the foot after removal of severe Talipes and a sound foot, 219.

Case XXIV.—Talipes varus acquisitus of the left side, with paralysis of the right. Permanent spasmodic contraction of the gastrocnemii, tibialis anticus, and tibialis posticus muscles of the left leg; partial paralysis of motion in the muscles of the right hip and thigh, with complete paralysis of those of the leg and foot. Division of the left tendo Achillis and tendons of the tibialis posticus and tibialis anticus muscles, 220.

Remarks.—Production of congenital Talipes illustrated by the non-congenital affection, 223. Nature of the morbid condition of the medulla spinalis investigated, 224. Inquiry into the causes of paralysis being sometimes not followed by distortion, 225. Consideration whether spasmodic contraction of the anterior tibial muscle can conjointly exist with that of the gastrocnemii, 225. Explanation of the manner in which spasmodic contraction of the anterior tibial muscle influences the form of the foot, 226.

Case XXV.—Talipes varus acquisitus (hystericus). Non-congenital distortion (Club-foot) of the right side, from spasmodic contraction of the anterior and posterior tibial muscles, the gastrocnemii and flexors of the toes, in conjunction with numerous symptoms of hysteria. The distortion cured by the administration of sesquicarbonate of iron, 228.

Remarks.—Reasons for resorting to medical treatment in preference to surgical operation, 232. Similar case operated, 233. Third case of hysterical contracture affecting the knee, 234.

Case XXVI.—Talipes varus acquisitus. Temporary distortion of the right foot, from spasm of the gastrocnemii and posterior tibial muscles, occurring during an attack of spasmodic croup, combined with a similar affection of both hands. Cured without operation, 234.

Remarks.—Importance of this case by illustration of the analogy with spasmodic affections of other parts of the body, 236. Origin of the distortion considered; explanation of the treatment, 237.

Case XXVII.—Congenital spasmodic elevation of the heels, combined with some rigidity of the knee and hip joints, arising from abnormal contraction of the muscles of the lower extremities; similar contraction in other parts of the body. Cured without operation, 238.

Remarks.—Co-existence of contraction in flexors and extensors, 240.

Case XXVIII.—Congenital Talipes valgus of the right foot, from contraction of the peronei, anterior tibial, and gastrocnemii muscles. Cured by division of the tendons of the peronei and gastrocnemii muscles, 241.

Remarks.—Greater care requisite after the cure of T. valgus to prevent relapse, than after T. equinus and T. varus; reasons for not performing division of tendon of anterior tibial muscle; cause of the tension of the gastrocnemii, and reasons for division, 244.

Case XXIX.—Paralysis of the lower extremities unaccompanied with distortion, 245.

Remarks.—Reasons for introducing the case; uncertainty in prognosis of paralysis in children, 246.

Case XXX.—Non-congenital Talipes equinus, from contraction of gastrocnemii from partial paralysis of their antagonists. Cured without operation, 248.

Remarks.—Dependence on irritation of worms in alimentary canal, combined with morbid sensibility of the mucous membrane.

Case XXXI.—Non-congenital Talipes equinus in both feet, from spasmodic contraction of the gastrocnemii muscles; similar affection of the muscles concerned in the articulation of sounds, 250.

Case XXXII.—Congenital distortion of the right foot, from contraction of the gastrocnemii. Cured by the application of mechanical instruments, 252.

Case XXXIII.—Intermittent spasmodic contraction of the left leg, occurring on contact of the sole with the ground, supposed to have been produced by an injury to the limb from accident. Cured by division of tendo Achillis, 254.

Remarks.—Case interesting in physiological and pathological points of view; comparison with other spasmodic affections of the system; probable existence of *reflex* connexion between gastrocnemii muscles and cutis of the sole; nature and cause of the lesion in the nervous system; occurrence of similar cases, 256.

Case XXXIV.—Non-congenital Talipes equinus from contraction of the gastrocnemii and other muscles on the posterior aspect of the right leg, converted by constant exercise into a deformity resembling in external appearance T. varus originating from paralysis. Cured by division of the tendo Achillis and subsequent mechanical extension, after the distortion had existed *forty-eight* years, 258.

Remarks.—Advanced age no obstacle to the performance of division of tendons, 262.

Case XXXV.—Talipes calcaneus. Distortion of the left foot from contraction of the tibialis anticus and extensores digitorum muscles, 263.

Remarks.—Talipes calcaneus constitutes a fourth species of Talipes; on the method of cure adopted, 265.

Case XXXVI.—Contracture or partial ankylosis of the knee-joint from white swelling. Cured by division of the tendons of the ham-string muscles. Considerations prior to undertaking the treatment by surgical operation; difference between the condition of the contracted muscles of the thigh and that of the gastrocnemii; mode of performing the operation, 266.

Description of knives for division of tendons, 275.

ERRATUM.

Page 57, line 15 from bottom, *for* 1836 *read* 1837.

INTRODUCTION.

In attempting a summary of the more important opinions entertained by those who have written on the morbid anatomy and causes of the distortions which form the subject of this Treatise, the comparative paucity of available materials becomes a necessary source of regret. Numerous works, on almost every other disease of the human frame, evince the attention devoted by the profession to their investigation; but none has received so little elucidation as club-foot and its analogous distortions. It is difficult to account for the apathy which has existed in the profession, until within a recent period, with respect to this branch of our art. The slowness of the ordinary methods of treatment — the frequency of failure—and the consequent abandonment of the cases to the resources of the mechanist,—may have somewhat contributed to this result; but the generally received opinion, that these diseases depend on deficiency of certain parts of the limbs, being malformations or monstrosities, may have possibly induced the idea of the hopelessness of the discovery of an effectual remedy, and impeded investigation into its morbid anatomy—a perfect knowledge of which will be found most calculated to explain the nature of the affection.

Some portion of that which has been written has rather retarded than advanced the subject, inasmuch as few of the authors have studied the morbid anatomy in infantile subjects, although so essential, as the condition of the limb

becomes at a later period much affected by external agents; —*e. g.* by improperly directed mechanical treatment, and the act of walking, by which the bones become displaced from their original morbid state, and thus increase the difficulty of discovering the origin of the disease. It will be presently shewn, that many of the published dissections have been made on adult subjects; and that the assertion of Scarpa, that the opinions derived from dissections of the feet of adults would be as numerous, and differ as much, as the feet dissected, is partially correct. Some appear to have conjectured the internal arrangement of the bones merely from the external form of the foot.

The various opinions of the best authorities may be arranged in three classes, and stated as follows, viz.

1. That the primitive formation of the bones is unnatural and incomplete.

2. That the bones, being originally perfectly formed, become injured and distorted by causes independent of the formative process; viz. by pressure occasioned by the fœtus drawing the limbs into unnatural positions; by an improper situation of the fœtus in the uterus; or by certain ligaments becoming elongated, and the articulations distorted, from contraction of some of the muscles and relaxation of others.

3. That, whatever may have been the condition of the bones on the occurrence of distortion, the act of walking displaces and injures them.

Glisson and Camper* were of opinion that Varus† arose

* I have not consulted the original work of Camper, which is in the Dutch language, and entitled "On Shoes, and the Evils occasioned by them." I have followed the statement of Scarpa.

† I have in this Introduction employed the designation of the disease adopted by the respective authorities quoted, except in the expression of my own opinions, when the disease is denominated Talipes varus. (See p. 2.)

from deformity, or even destruction, of the astragalus, and that the affection was consequently incurable. Blumenbach* attributed the principal cause of Varus to an unnatural shortness of the neck of the astragalus. Naumburg† and Wanzel‡ considered this bone to be distorted and displaced. Brückner§ combats the opinion of the dependence of Varus on a partial luxation of the tarsus. Scarpa‖ ascertained the existence of only slight deformity of the individual bones, and that the os scaphoides, os cuboides, and os calcis, were displaced; while the astragalus was the least affected, and was invariably more or less completely situated within the articular cavity formed by the tibia and fibula.

Jörg¶ dissected two feet affected with Varus: one, of a man aged sixty years; the other, of a boy aged thirteen. In the former the shaft of the tibia was twisted anteriorly and outwardly, so that the internal malleolus, which was smaller than natural, presented forwards; while the external malleolus had receded. The articular surface of the inferior extremity of the tibia had undergone so great a change as to be scarcely

* "Geschichte und Beschreibung der Knochen des menschlichen Körpers." Göttingen, 1786, p. 440.

† "Abhandlung von der Beinkrummung, von J. S. Naumburg." 8vo, Leipzig, 1796.

‡ "Dissertatio inauguralis medica de Talipedibus Varis, auctore D. M. Wanzel." Tubing. 1798. Wanzel had been affected with Talipes varus, and described the successful plan of treatment he underwent in Switzerland.

§ "Ueber die Natur, Ursachen und Behandlung der einwärts gekrümmten Füsse. A. Brückner." Gotha, 1796.

‖ "Memoria chirurgica sui piedi torti congeniti dei fanciulli, e sulla maniera di corregere questa deformità, di Antonio Scarpa." 4to, Pavia, 1803. The drawing of the arrangement of the tarsus in Talipes varus, contained in Scarpa's work, corresponds in all material points with that published in this Treatise, fig. 8.

¶ "J. C. G. Jörg über Klumpfüsse, und eine leichte und zweckmässige Heilart derselben." Leipzig und Marburg, 1806, pp. 15-23.

recognisable, being adapted to receive the astragalus, which was so distorted as to resemble the segment of a sphere, the remains of its round head being directed outwards, and the posterior part turned inwardly; the whole being rotated on its perpendicular axis, and inclined forwards and downwards. The ginglymoid articulation of the ankle was consequently converted into a ball-and-socket joint. The part corresponding to the round head was not invested by the os scaphoides; the tuberosity of the os calcis inclined inwardly, and its anterior process outwardly; the entire bone was rotated, so that the external margin presented downwards, and the inferior margin inwardly. The os naviculare had advanced towards the internal malleolus, and its internal extremity had become raised. The position of the os cuboides was altered, so that its external portion was applied to the ground. In the other case related by Jörg, the deformity had reached the highest degree; but the form of the individual bones being unaltered, the description of the dissection corresponds with the opinions of Scarpa. Clossius* describes this as likewise the case in one of the feet of a man stated to be affected with Varus in both extremities. In the other foot, wherein the external deformity was greater, the round head and neck of the astragalus were directed inwards and downwards, being flattened on their internal surfaces; the superior trochlea of the astragalus was altered in its position, so that a considerable portion of its superior surface was not opposed to the tibia, this bone having caused the formation of a new articular surface on the posterior part of the body of the astragalus; and the external surface of the trochlea, by protruding anteriorly, was not in contact with the articulating surface of the external malleolus. Clossius further relates, that the os

* "Ueber die Krankheiten der Knochen." Tübingen, 8vo, p. 270.

scaphoides was connected in the most perfect manner with the three cuneiform bones, but that it almost touched the internal malleolus.

Colles* concluded, from two dissections of Varus (the one a child of five years, the other a youth aged eighteen), the existence of several grades of Varus, and that distortion of the individual bones resulted from their displacement, and the injury arising from walking. In the former, many of the muscles had assumed the colour of adipose tissue, but retained their fibrous structure; the tendons of the tibial muscles were disproportionably long, and, in consequence of the deformity, had swerved from their natural direction. The internal malleolus was situated more forward than the external malleolus, by upwards of an inch; the superior surface of the trochlea of the astragalus was divided by a transverse ridge into two portions, which he considered would have presented a serious obstacle to the replacement of the foot. The os scaphoides was drawn inwardly from the round head of the astragalus. The other case presented less deformity; but he concluded that the oblique position of the tarsal joint, and the altered form of the astragalus, were the primary causes of the distortion.

Mackeever† investigated the anatomy of three cases of congenital distortion in infants: he found that the tuberosity of the os calcis touched the fibula, and that the os naviculare was in contact with the internal malleolus, and adherent by strong bands of fibrous tissue; on division of which the foot was readily restored to its natural position. The tarsal bones differed but little from the normal state; the muscles were of the ordinary bulk, and the tendons of the usual length. In those situations where the bones had come into

* Colles' "Dublin Hospital Reports," vol. i. p. 184.

† "Edinburgh Medical Journal," vol. xvi. 1820, p. 220.

unnatural contact, the surfaces were smooth, somewhat resembling a natural articulation.

Palletta,* finding the internal malleolus deficient in size, concluded this to be the cause of the foot being drawn inwardly by the adductor muscles. In the dissection of an infant six days old, he found that the os scaphoides was not applied to the round head of the astragalus, but had been drawn inwardly beneath the internal malleolus; the neck of the astragalus also inclined inwardly, but the trochlea was properly placed between the malleoli; the remaining bones of the tarsus followed the direction of the os naviculare. He found a similar alteration in the arrangement of the tarsus of a child twelve months old, and alludes to the approximation of the tuberosity of the os calcis to the external malleolus.

The researches of Delpech,† although valuable with respect to the pathology and treatment of the disease, add but little to the information previously acquired on its morbid anatomy.

Cruveilhier states,‡ that in his dissections of Varus he observed the atrophy of the muscles to be more complete than that of the bones. In a female aged forty-one years, the nerves distributed to the muscles were much reduced in size, the neurilema being nearly the only portion remaining; the tibial arteries and veins were reduced to one half the ordinary size, and no branch distributed on the muscles had admitted any of the coloured wax with which the arterial trunks had been injected; the whole of the muscles, with the exception of the internal portion of the gastrocnemius externus, had undergone the adipose transformation; the

* "Exercitationes Pathologicæ." Mediol. 1820, p. 138.

† "Chirurgie Clinique de Montpellier." Paris et Montpellier, 1823, p. 200.

‡ "Anatomie Pathologique." Livraison II. 1830.

tendons were very slender, that of the gastrocnemii being developed to only half its natural size. A smooth and oval surface was formed at the extremity of the internal malleolus, by which the tibia was applied to the internal surface of the os calcis; the opposing surfaces were invested with cartilage. (A reference to fig. 6, plate 3, of Cruveilhier's work, shews the inward inclination of the os naviculare: a general correspondence exists between his representations of Varus and fig. 8 in this Treatise.) He considers the unnatural form of the bones of the tarsus in congenital Varus to arise prior to ossification.

Löb* published a description of the tarsal bones of an adult female affected with Talipes preserved in the museum at Bonn. The alteration of the articular surface of the astragalus was in his opinion sufficient to have prevented the restoration of the foot; the upper part of the os calcis, which is rough in the normal state, presented two smooth surfaces covered with cartilage, which were continuous with the trochlea of the astragalus; so that, from the extreme state of extension in which the foot had been retained, the os calcis entered into the composition of the ankle-joint. The os naviculare had gone inwardly from the round head of the astragalus, followed by the os cuboides, leaving a space between itself and the anterior part of the os calcis. (Compare this description of the changes in position of the bones with fig. 8 in this Treatise, with which it corresponds.)

Tourtual,† convinced of the importance of the study of the anatomy of Varus at an early period of existence, examined the feet of an anencephalous seven months' fœtus thus affected. The navicular and cuboid bones were rotated on their axes, and with the astragalus were partially dis-

* "Dissertatio inauguralis de Talipedibus Varis." Bonnæ, 1830.

† "Zweiter anatomischer Bericht." Münster, 1832.

placed; the posterior surface of the latter articulated with the tibia, instead of the superior surface, resulting from the extended position of the foot. The round head of the astragalus inclined somewhat inwardly, its superior trochlea, which appeared longer than natural, presenting forwards and inwards. The former and the anterior articular surface of the os calcis were prominent, and were simply covered with the skin and aponeuroses.* The os scaphoides touched the internal malleolus; and, contrary to the testimony of Scarpa, Delpech, Jörg, Duverney, and Chelius, Tourtual found the posterior tuberosity of the os calcis drawn towards the fibula upwards and outwards. The tendon of the anterior tibial muscle, in consequence of the inward yielding of the fore-part of the foot, was twisted around the anterior angle of the tibia, and became inserted into the first cuneiform bone, after having passed behind the malleolus internus, instead of in front.†

* In both feet of a nine months' hemicephalous fœtus, affected with the severest grade of T. varus, I found the round head of the astragalus and the articular surface of the anterior extremity of the os calcis presenting downwards, and situated immediately beneath the skin.

† I have never yet, in infantile cases, been able to perceive that this tendon was directed behind the malleolus internus; but I have observed its course over the anterior angle of the tibia somewhat higher than natural; after which it became unnaturally inclined inwards towards the internal cuneiform bone, into which it was inserted by a band of unusual width. The inferior extremity of the tendon was therefore more internally situated than the malleolus internus, resulting from the altered position of the front part of the foot. In both feet of a hemicephalous fœtus the whole of the muscles and tendons were much smaller than in a well-formed fœtus, having been with difficulty dissected; the entire limb was well encased in adipose tissue, precluding, from its bulk, any suspicion of the extent of the atrophy of the muscles. This imperfect development of the muscles is not always present in fœtuses affected with Varus, as I have observed the development to vary in different fœtuses, and occasionally to equal the natural bulk. It may be stated, as a general rule, that in proportion to the extent of the deformity is the

As the opinions of Scarpa generally agree with the results of my own experience published in this work, I have hitherto detailed them with less minuteness than their importance otherwise deserved. The conclusion at which he had arrived was, that, of the entire tarsal bones, the astragalus had suffered the smallest degree of displacement; which alone proved the possibility of curing infantile T. varus. The determination of this point was of infinite moment, the astragalus being the most important tarsal bone, and the only one entering into the composition of the ankle-joint. Jörg, Colles, Delpech, Löb, Cruveilhier, having principally confined their anatomical observations to the feet of individuals who had passed the age of infancy, have impugned the accuracy of Scarpa's conclusions. But Palletta, Mackeever, and Tourtual, describe no alterations in children of the form or position of the astragalus, which, on removal of the obstacles to flexion or abduction of the foot, would have prevented its articular trochlea performing its functions in the tibio-tarsal cavity; although several trifling changes in the bone are related by the latter anatomists. I have described the essential anatomical characters of Varus at p. 13 in this Treatise: in every instance I have examined, either of an infant or adult, however great may have been the state of extension and adduction of the foot, some portion of each of the three articular surfaces of the trochlea of the astragalus was in contact with an equal proportion of the three articular surfaces presented by the tibia and fibula in the ankle-joint. The astragalus usually inclined inwardly, but only to such an extent as to cause the external surface of its trochlea to project from the ankle-joint somewhat farther than the internal surface.

amount of the atrophy: thus, in a seven months' hemicephalous fœtus affected with a slight grade of T. varus, the muscles were better developed than in a similar fœtus of nine months, in which the deformity was greater.

The deviation of the os calcis is next in extent to that of the navicular bone; in a sound foot, the round head of the astragalus is principally supported by the inferior calcaneo-scaphoid ligament, which sustains a considerable portion of the weight of the body; but in severe Varus the anterior extremity of the os calcis is forced inwardly as far as the round head of the astragalus, and occasionally beyond it, taking the office of the calcaneo-scaphoid ligament; and the posterior tuberosity of the os calcis is consequently directed outwardly towards the fibula. It is possible that the two following symptoms occurring in Varus may have deceived several authors, and induced the opinion that the posterior tuberosity of the os calcis had yielded inwardly: — first, the apparently inward inclination of the heel, owing to the length of the inner margin of the foot being so much diminished, and rendered hollow by the front part being drawn both inwardly and backwards. Secondly, the appearance of the anterior extremity of the os calcis on the external aspect of the foot; which is likewise a result of the inward twisting of the navicular, cuboid, cuneiform, and metatarsal bones (see fig. 36). The extent of separation of the cuboid bone from the os calcis varies considerably, being sometimes insufficient to form the triangular interval described p. 13; but I have witnessed in fœtuses, affected with the highest grade of deformity, denudation of the anterior extremity of the os calcis by the os cuboides, its entire articular surface being simply covered with the integuments.

The summary of the investigations of the anatomy of Varus may be concluded in the words of Scarpa:—"None of the tarsal bones are actually dislocated; but in addition to the state of extension of the ankle-joint, they undergo rotation on their axes, and the astragalus suffers less alteration of position than either of the tarsal bones."

The opinions of the causes of club-foot, by which pathologists have been divided, are, either that the affection primarily depends on a disturbance of the balance between the muscles situated on the anterior and posterior aspects of the leg; or that, on the contrary, it is attributable to a derangement in the primitive formation and connexion of the tarsal bones.

It is remarkable that the former opinion, which is the more correct, partially corresponds with that of Hippocrates;* but whether Hippocrates considered the causes of displacement to be resident within the limb, or to arise from external influences, cannot, from his language, be determined: "Modus mutilationis non unus est sed plures. Plerumque non quod ex totâ sede suâ elapsus est articulus, sed in aliquâ detinetur, eo habitu assuevit, pes varus efficitur." By the detaining power alluded to, he may have understood either external mechanical agents, or the unequal action of certain muscles.

Glisson and Camper, as already shewn, considered the irregular form of the astragalus to be the essential cause.

B. Bell† alludes to Talipes in the following manner: "Limbs may be distorted in various ways, and by different causes, either from morbid state of bone, or from contracted state of muscles, or both. The malformation of the bones is the effect of rickets; but the most frequent cause of distorted limbs is contraction of flexor muscles of the leg and forearm." He alludes to the prevailing opinion among medical practitioners, that no advantage resulted from remedies, and to the circumstance of this class of affections having been left to itinerants; and states that, having in early life observed the misery to which patients with distorted limbs were reduced,

* Vide "Lib. de Articulis."

† "A System of Surgery," by Benjamin Bell. 1788, vol. vi. p. 281.

he resolved to attempt the cure; and that in many instances he had the satisfaction of relieving, and in some cases effected a complete cure. He adds, that the joint becomes in few cases affected by long continuance of distortion.

Duverney asserted that the *monstrosity* depends on the unequal contraction of the flexors and extensors,* the weaker muscles being drawn by the stronger and more contracted in an opposite direction; whilst the unfortunate patients instinctively favour the increase of the deformity by turning the feet in the direction of the action of these muscles.

Boyer† admitted the inequality of power of the abductor and adductor muscles to be the origin of Varus and Valgus, but believed that congenital Varus might be produced by an improper position of the fœtus in the uterus. He attributed the occurrence of Varus after birth to the nurse having permitted the infant to place the limbs in irregular positions; and as the bones are at this period cartilaginous, and can be compressed into any form, he recommended that the cure of the distortion should be undertaken immediately on being perceived. He was also of opinion that if the process of ossification be completed during the continuance of the deformity, the bones will for ever retain their form, and the distortion of the limb remain irremediable.

Scarpa thought that Duverney had mistaken the effect for the cause, and stated that proof might be adduced of the primary origin of the disturbance in the osseous system, through which the insertion of some of the muscles became approximated to their origin, and that of others removed from it; the former becoming shortened, the latter elongated,

* "Traité des Maladies des Os," tome ii. chap. 3.

† "Leçons du citoyen Boyer, rédigées par A. Richerand." Paris, 1803, tome ii. p. 247.

in the same manner as distortion occurs in fractures and dislocations. He, however, concedes, that in infants, after the occurrence of distortion of the bones, the disturbance of the equilibrium in the power of the muscles greatly contributes to maintain the deformity.

Jörg,* on the contrary, distinctly states that the action of the muscles is the proximate cause, and regrets that Scarpa omitted to publish the proofs of the primary occurrence of distortion of the bones. Jörg was led to this opinion by witnessing the occurrence of Varus from an apoplectic seizure.

Rudolphi† gave a more complete view of the origin of T. varus than any of his predecessors, and one more consistent both with physiology and pathology. He concluded that congenital Talipes, and the analogous deformity of the hand (club-hand), arise from disordered influence of nerves on muscles in the fœtal state, by which their contraction is prematurely excited,‡ and often in so vehement a manner, that the mother experiences pain from the convulsive motions; the limbs thus become distorted, and permanent deformity is often thereby occasioned. He observes, that the authors who have maintained the injurious influence of external and mechanical causes, such as pressure of the uterus, through an improper position of the fœtus, appear to have been unaware that these distortions are not unfrequently witnessed in embryos of three or four months.§ Rudolphi not only points out the influence exercised on the muscles of the

* Op. cit. page 87.

† "Physiologie," 6tes Buch, p. 323.

‡ Ib. p. 319.

§ Several embryos of three to five months, affected with Talipes, and exhibiting malformations or deficiency of the cerebrum and medulla spinalis, are contained in the Berlin Museum, collected by Rudolphi and Müller. Some are anencephalous, and others hemicephalous, both the hands and feet being

extremities, by powerful and general causes affecting the entire nervous system of the fœtus, but states that Talipes often occurs in infants, in other respects well-formed, from simple spasm.

Delpech,* in his first publication on the subject, adduces but few important arguments in support of the opinion adopted by him, that the deformity of club-foot arises from malformation of the tarsal bones.† He, however, appears to have been aware of the insecurity of the basis of this theory, and admitted that the success attending his curative exertions might be advanced as an argument against it; having followed that observation by inquiring how it happened that these affections were so speedily remedied, if they depended on serious malformations of the bones. He also raised the question whether—admitting that a simultaneous inclination of all the bones towards the same side favoured the opinion that the distortion arose from muscular action—a derangement of the muscles, affecting their length, might not be capable of producing a disturbance of the position of the bones, and consequent deformity of the limb. He considered the existence of a conjoint affection of all the anterior or posterior muscles of the leg, by which their development in relation to the bones might be impeded, and a shortening result, to be more *natural*, than that the entire bones should become so affected as to alter their form on a regular and systematic plan, and thus produce an universal deviation of the whole of the articular surfaces in one direction. In opposition to these arguments, the importance of which he admitted, he asserted that the change in the form of the bones

affected in this manner, shewing the extensive participation of the system in the disturbance and destruction of the nervous centres.

* "Chirurgie Clinique de Montpellier." Paris et Montpellier, 1823.

† Ib. p. 166.

is observed to precede the shortening of the muscles, but adduces no proof in support of this assertion. He also states, that at birth the muscles do not contribute to the maintenance of the deformity, the foot being at that period readily reducible to the proper position.

This statement is erroneous; for although the foot can frequently be restored by pressure to its natural position, many instances occur in which a slight amendment only can be thus effected; and in all cases the resistance of the muscles is perceptible. Delpech, however, conceded with Scarpa the influence exercised by the muscles on the progress of the affection, in explanation of the increase of the deformity.* As Delpech, in a treatise† published six years afterwards, renounced the opinion of the dependence of Talipes on primary disease of the bones, the relation of his earlier opinions might have been unnecessary, had they not been still entertained by other authors. He was induced to conform to the theory, that these distortions arise from muscular action, by witnessing the occurrence of two cases of Varus at an age when the bones had acquired complete development; one, that of a soldier whose external popliteal nerve had been injured by a gun-shot wound in the thigh, succeeded by paralysis of the peronei, tibialis anticus, extensor longus digitorum, and extensor proprius pollicis muscles. Deformity ensued through contraction of their antagonists. The patient, on recovery from the first effects of the injury, walked on the external edge of the foot, then on the instep, and ultimately on a protuberance formed by the anterior extremity of the os calcis, the dorsal surface of the os cuboides, and the malleolus externus.‡

* Op. cit. p. 199.

† "De l'Orthomorphie." Paris, 1829.

‡ I have never seen the malleolus externus applied to the ground, not-

The other case is equally interesting, as it demonstrates the production of a similar deformity from an opposite cause. A woman at the age of twenty-four years became affected with abscesses in the thigh and necrosis of the femur; and during the progress of the disease, which continued for three years, great contraction of the posterior muscles of the leg occurred, either through *sympathy* or propagation of the deep-seated inflammation to the sciatic nerve, the foot being drawn both downwards and inwards, and distorted so as to resemble complete Varus. Delpech states that he had never previously witnessed so severe a case of Varus, the toes being drawn to within three inches of the heel. Notwithstanding the abandonment of the opinion of the existence of a primitive affection of the osseous system, and the subsequent assumption that the deformity was attributable to active contraction of the muscles from affections of their nerves, followed by passive contraction through atrophy and suspended development, he supposed that the gastrocnemii were the only muscles involved in the production of Varus, the inward inclination of the foot being gradually produced by pressure exercised in the act of walking. It is doubtful whether Delpech ever witnessed the more severe gradations of T. varus, in which the child, on the first attempts to walk, inevitably treads on the instep; although he describes the presence of a slight inward tendency of the point of the foot at birth, which he endeavours to explain by stating that the posterior tuberosity of the os calcis spontaneously inclines somewhat inwardly. But even were this the case, and the heel likewise drawn further inwardly by the contracted gastrocnemii, it would follow, in the absence of contraction of other muscles which might

withstanding the extent of the deformity; but the part is sometimes invested with a corn produced by friction against the shoe.

direct the toes inwardly, that they would be directed outwards. It has, however, already been stated, that the posterior extremity of the os calcis inclines externally towards the fibula. But another cause of the inward inclination of the front part of the foot exists—contraction of the other extensors and the adductors.

Maisonnabe believed that T. varus depends on shortness of the plantar fascia. This opinion, as Delpech observes, may be refuted by the single observation, that it is insufficient to explain the occurrence of Talipes valgus.

Cruveilhier,* notwithstanding his valuable contributions to the pathology of club-foot, adopted the unsatisfactory explanation of its production by a mechanical cause. He, however, arrived at the conclusion, that club-foot is not produced by pressure exercised by the uterus on the fœtus, or by any external pressure acting on the mother; being aware of the birth of infants affected with Talipes during whose uterine existence there had been no deficiency of liquor amnii, and of that of well-formed infants wherein a paucity of liquor amnii had been observed. He was also cognisant of the fact, that pregnant women who have received blows and contusions on the abdomen, and others in whom, from the desire of concealing pregnancy, injurious pressure on the uterus had been maintained, have nevertheless given birth to children free from distortion; whilst many women, who had neither been exposed to injury nor subjected to pressure on the uterus, have been delivered of infants affected with Talipes. But, prepossessed in favour of the existence of a mechanical cause of the deformity, he became convinced that club-foot and club-hand arise from the limbs of the fœtus being arranged in improper positions in relation to each other and to the trunk

* "Anatomie Pathologique du Corps Humain." Paris, 1830, livraison ii.

of the body, by which their mutual development is impeded. In corroboration of this opinion, he affirms that the carpus being composed of small bones, and its articulation very loose (the reverse of the ginglymoid articulation of the ankle), no deformity of the hand analogous to Talipes varus could occur, as the fœtal distortion of the carpus and metacarpus disappears after birth, the removal of the pressure causing their return to the natural form and position. The inaccuracy of the statement of the spontaneous disappearance of club-hand after birth, proves the fallacy of the inference. I have observed, in several fœtuses contained in the Berlin Museum, affected both with club-hand and club-foot, that the hands could be reduced by pressure to their proper position; but, like club-foot, on the removal of the pressure, they relapsed into the distorted state. I have likewise seen a youth, aged seventeen, born with these deformities of the feet and hands: the distortion of the former gradually increased through the injurious effects of exercise, the rigidity of the contraction being so great, that I was unable by pressure with the hands to effect any diminution of the deformity. The hands, the left being the more distorted, had remained in a position similar to that presented at birth, except that, until he commenced exercising the power of volition, they were maintained in an extreme state of flexion and pronation, being closely applied to the anterior and internal surface of the fore-arm. At this period he endeavoured, by exerting the extensor and supinator muscles of the wrist, to overcome the contraction of the flexors and pronators. Hence, the hands are not at all times so fully contracted as at birth; but on the withdrawal of the influence of volition from the extensors and supinators, these muscles yield to the contracted flexors and pronators, and the hands assume the original distorted position. The left is then closely applied

to the anterior and internal surface of the fore-arm; the right, being more controllable by the extensors and supinators, spontaneously occupies a less distorted position. The resistance of the flexors and pronators is distinctly perceived on attempting to place the hands in a proper position. Had Cruveilhier witnessed a case of club-hand in the living subject, he would not have asserted that this affection is spontaneously remedied after birth. Club-hand suggests many important reflections, being precisely analogous to Talipes varus. The simultaneous existence of flexion and pronation in club-hand is strictly comparable with the extension* and adduction of club-foot.†

When both extremities are affected with Talipes, the left frequently exhibits the higher grade of deformity: this was the case in the present instance. The distortion of the hands thus presented a further analogy, as the muscles of the left were less controllable by volition, occasioning a greater deformity. The superiority of the right hand might be explained by the supposition that it was more employed than the left; but this patient was unable even to use the right in the majority of actions in which it is usually employed; and to supply the deficiency, he generally resorted to the use of both, more particularly in the act of

* See note, p. 40.

† Since writing the above, I have witnessed an adult congenital case of club-hands and club-feet. The distortion of the hands corresponded with the above description, and the analogy with club-foot was still greater; as, in addition to the affection of the flexors and pronators of the wrist, several muscles in the palm of the hand, particularly the opponens and flexor brevis pollicis, were contracted in precisely the same manner as the muscles of the great toe in Talipes. The left foot was similar to fig. 5 in this Treatise; the right resembled fig. 32. Distortion of the hand may also possibly occur from unnatural contraction of the extensors and supinators of the wrist. I have not witnessed an instance: should it exist, it will in all probability be found to constitute a deformity analogous to Talipes valgus.

grasping or lifting. This explanation is inapplicable to the left foot; for it cannot be contended that persons affected with Talipes in each foot exercise either in preference. The existence of this analogy between Talipes and club-hand strengthens the opinion of the dependence of these distortions on abnormal muscular contractions. It might, indeed, be considered a singular occurrence that a mechanical cause, —such as the limbs during fœtal existence becoming twisted into unnatural positions, and impeding their mutual development,—should invariably induce relaxation, followed by shortening of certain muscles physiologically associated, and also stretching, followed by elongation of other muscles.

But in the demonstration of the dynamic cause of club-foot, allusion to the analogy of club-hand is unnecessary: the characters of the former may be further investigated without any reference to club-hand. As in Talipes varus, the navicular, cuboid, and cuneiform bones, with the metatarsus and toes, are inwardly inclined by the agency of external pressure, so that the navicular bone is brought in contact with the internal malleolus, how happens it that these parts are never thrust in the opposite direction by the navicular and cuboid bones becoming forced from their connexions with the astragalus and calcaneum, and by the cuboid bone becoming placed in contact with the external malleolus? If the distortion were produced by external violence, the mechanical arrangement of the tarsal bones would permit the os naviculare and os cuboides to be forced outwardly as readily as inwardly. But this never occurs, as no muscles capable of drawing these bones outwardly are inserted into them. Talipes valgus is the deformity most opposed to Talipes varus (see p. 4); but although an affection as opposite as can be produced by the contraction of the contrary sets of muscles, yet if the

distinctive character of T. varus was described as an inward twisting and rotation of the front of the foot, by separation of the navicular and cuboid bones from the astragalus and calcaneum, the peculiarities of Talipes valgus could not be contrasted as opposite; for in this distortion the entire foot is maintained in a certain position from muscular action, but no *outward* twisting in particular of the front of the foot takes place from separation of any of the tarsal bones. The constant recurrence of the same series of pathognomonic symptoms in Talipes contributes to prove its non-dependence on external causes. Every disease is characterised by a peculiar mode of evolution, accompanied by the same essential symptoms. Talipes has its distinctive traits equally with peripneumonia, variola, epilepsy, or hernia; indicating that its production takes place according to certain internal pathological laws, and not from the operation of external agents.

Tourtual inclines to an opinion of Cruveilhier, that the frequent co-existence of Talipes in both limbs, and the occasional accompaniment of "monstrosities of other organs," are proofs of its dependence on an unnatural shape of the astragalus. But I am of opinion that this complication in fœtuses affected with Talipes tends less to prove its dependence on primary malformation of the bones, than on some powerful cause disturbing the nervous centres, and affecting the functions; and in severer Talipes impairing the development of the nerves and muscles of the distorted limb.

Philip von Walther* has attempted an ingenious but insufficient explanation of Talipes, which is here introduced to complete the summary of the opinions on the nature of these distortions, as far as my investigations extend. The untenableness of his theory may be demonstrated by a

* "System der Chirurgie," Band i. p. 349. Berlin, 1833.

reference to the discoveries of others in the history of the development of the human embryo. Were its accuracy admitted, we should return to the notion that Talipes is a monstrosity by defect. He states: "Talipes is a natural grade of the development of the foot, and embryos of three or four months very frequently *retain* one or both feet in this state. The foot as well as the hand (and other members of the trunk) are formed from a bladder filled with fluid, which bursts along its internal side, the inner and outer edge of the foot resulting from the margins of the rupture, the sole being formed by the space afforded by their expansion and separation. The future external margin of the foot is at first drawn downwards; the sole, which is still very concave, presents internally; the future internal margin is directed upwards; and the back of the instep looks outwardly:" thus constituting a complete Talipes varus. From this it would follow, that every fœtus, at an early period of development, has two club-feet. But if Talipes varus be a state of natural embryo-development, the inquiry may be instituted as to which of its natural stages Talipes equinus and Talipes valgus are respectively referrible. By whatever further stretch of imagination this theory may be applied to the explanation of Talipes equinus, its application to Talipes valgus is decidedly inadmissible.

His explanation of the manner in which the feet (Talipedes vari) of all embryos, during the progress of development, are converted into natural, well-formed feet, is equally ingenious. He states: "The flexors of the foot (tibiales anticus and posticus, the gastrocnemii,* and more particularly the soleus

* P. von Walther regards the muscles on the posterior aspect of the leg as flexors, in consequence of their pathological relations. See note, p. 40. He has erred in classing the tibialis anticus with the gastrocnemii as a flexor; for although it bends the foot, it is, according to his nomenclature, an extensor.

and plantaris), and the flexors of the toes, are the muscles first formed, and the action of which originally predominates. The extensors (peronei and extensors of the toes) are subsequently formed, and oppose the first series of muscles, and ultimately keep them extended; the foot is gradually directed outwardly, the sole becoming flattened; but the external margin of the foot is not drawn outwardly (and upwards), in consequence of the extensors (and abductors) not having at this period acquired sufficient power. Should the foot remain in this grade of development, Varus will be discovered at birth, the contracted and shortened flexors preponderating over the elongated and debilitated extensors, as they naturally do at an earlier period of uterine existence. . . . The propensity of the generality of infants to tread on the outer edge of the foot results from the circumstances attending the former stage of development—the last remains of a slight grade of T. varus."*

A more cogent argument against the theory of P. von

Observing its contraction in T. varus, he could not separate it from the gastrocnemii: he should therefore have denominated it adductor in relation to this distortion, from its assisting to draw the foot inwardly.

* Dr. Pockels directed my attention, during a visit to Brunswick, to the opinion that T. varus is an unnatural increase of the propensity of children to turn the feet inwardly. I believe that this propensity depends on the organisation of the muscles and the structure of the ankle-joint, which tend, in the absence of volition, to produce an inward inclination of the toes. During fœtal existence, and prior to the exercise of volition in infants, as well as during sleep, the limbs are under the influence of the involuntary contractile powers of the muscles. The extensor and adductor muscles, constituting the larger mass of muscular fibres, maintain in the embryo and infant the inward inclination of the toes and the elevation of the heel, although the foot is occasionally moved in every direction. To explain more fully — the child is at first disposed to tread on the external margin of the foot, because the muscles are only gradually subjected to the control of volition; but by continually striving against the involuntary contractility of the muscles, perfect use of the feet is finally acquired.

Walther is the circumstance, that other observers of the phases in development of the embryo have not witnessed the formation of the hands and feet from a bladder, by the rupture of which, and the separation of its margins, the edges of the foot are formed in the manner described by this anatomist.*

Stromeyer† enumerates the following causes of distortions, in every part of the body, arising from unnatural contraction of associated muscles.

1. Structural changes in the muscles, inflammation, and wounds, with loss of substance. (These causes, however, induce contracture, but not true Talipes equinus, varus, or valgus.)
2. Debility and inactivity of antagonists, produced—
   a. By wounds of tendons, or of the bellies of antagonist muscles. (This does not produce true Talipes.—See page 2.)
   b. By paralysis of the nerves of the antagonist muscles; this may be complete or partial, and affect either the voluntary or involuntary (reflex) motor powers.
3. Diminution of voluntary power in the entire limb, without paralysis of the sympathetic nerves, through which the flexors (in the foot, the extensors) preponderate over the extensors (in the foot, the flexors) by the constant organic contraction of the muscles.
4. Painful affections of the part, restraining or prohibiting motion, such as that from inflammation of a joint. In this instance also the extensors succumb to the flexors. This cause possesses great affinity

* See "Valentin, Entwickelungs Geschichte des Menschen," p. 245.

† "Ueber Paralyse der Inspirations-Muskeln." Hannover, 1836.

with the preceding one (although it does not produce true Talipes.—See Cases X. and XI.).

5. Increased energy in the muscle, morbid contraction or motion in the muscular fibres—tonic spasm. The muscle, through constant contraction, becomes inert with reference to its particular function, but continues in a state of tension from its fibrous structure.

The inward inclination of the fore-part of the foot, which constitutes the difference between Talipes varus and T. equinus, has by Stromeyer been attributed to deficiency of the internal malleolus; Delpech and Cruveilhier are also of opinion that this cause greatly contributes to the maintenance of T. varus. I have not observed, in the fœtal or adult instances of T. varus that I have dissected, any material deficiency of this process. After long continuance of the tarsal bones in their improper position, and consequent compression or friction by the navicular bone, it occasionally becomes smooth at the extremity; but this cannot much affect the ankle-joint. The deficiency, when existing, should be regarded as an effect, and not as a cause.

The ligaments cannot directly influence the production of the deformity, but its progress may be facilitated by their relaxation: the restoration of the foot is impeded by their diminished length, the result of long continuance in an improper position.*

Stromeyer is of opinion, that if contraction of the gas-

* Cruveilhier erroneously contradicts the opinion of Scarpa, that in T. varus the external ligaments of the ankle are elongated. I have found the internal lateral or deltoid ligament shortened, and possessing considerable density. Mackeever (Edinburgh Medical Journal, vol. xvi. p. 220, 1820) states that in the T. varus of an infant in whom the os scaphoides with the os cuneiforme internum were drawn close to the internal malleolus, he could not abduct the foot until he had divided this ligament.

trocnemii muscles occur during the later period of uterine existence,—after the ankle-joint has acquired a certain degree of firmness by the development of the internal malleolus, and the ligaments of the joint having been fully formed,—Talipes equinus, either with or without a slight inward inclination of the foot, is presented at birth; whereas, should the muscular contraction occur at an earlier period, Talipes varus is the result.* And as the majority of cases of T. equinus, and the milder forms of T. varus, are curable by division of the tendo Achillis only, he considers the shortening of the muscles of the calf the essential cause of the whole of these distortions, the peculiarities of each being regarded as secondary phenomena. He likewise doubts the influence of the anterior tibial muscle in the production of T. varus, and observes that this muscle cannot draw the front part of the foot inwardly whilst the heel is elevated and the foot extended beyond a right angle with the leg;† and consequently, that as this extension takes place in T. varus, the influence of the tibialis anticus must of necessity be very slight, and of secondary importance. He admits the existence of contraction of the tibialis posticus, but considers the situation of this muscle cannot permit any great contraction of its fibres, and entertains doubts of the utility of dividing its tendon.

But little doubt can exist that the cure of congenital dis-

* Stromeyer, "Beiträge zur operativen Orthopädik, oder Erfahrungen über die subcutane Durchschneidung verkürzter Muskeln und deren Sehnen." Hannover, 1838.

† In my former dissertation, I expressed the same opinion; but I have since been compelled to differ from my respected and talented friend, to whom I am indebted for the great and lasting benefit of the removal of my former lameness. Many of the Cases related in this Treatise indicate the existence of contraction of this muscle. See Cases XXIV. and XXV., wherein the manner in which it affects the form of the foot is demonstrated.

tortions was attempted in the infancy of surgery, although their occurrence may have been less frequent than in the present state of civilisation. The observation of the facility with which the feet of infants affected with congenital Talipes are occasionally reducible to a natural form by moderate pressure with the hands, must at the earliest periods have suggested attempts at cure by the application of bandages and simple mechanical apparatus.

Hippocrates* describes the bandages to which he resorted for the cure of Varus; and his success may be estimated from the encomiums he bestows on them,—"citius enim talia medicinæ obtemperant, quam quis putaverit." The candour displayed throughout the writings of the father of medicine leaves little doubt that he has not exaggerated the success which he experienced; and we may conclude that, by commencing the treatment at the earliest period of life, aided by his unremitted perseverance, many of these distortions were remedied. An observation, which would have been passed unheeded prior to the introduction of the division of the tendo Achillis, follows the last quotation: "atque quidem est curatio, et neque sectione, neque ustione, neque aliâ varietate quicquam opus habet"—of the import of which doubts may now be entertained. Whether Hippocrates, or any of his contemporaries, had discovered the means of curing this distortion by section of tendons, but, preferring the application of bandages, nevertheless rejected it, or whether he employed this observation with a different meaning, cannot at the present day be decided. It is possible that Hippocrates, being accustomed to cure external disorders by the knife or cautery, may have adduced his treatment of this disease as an exception to the more severe methods so frequently resorted to in other affections;

* Op. cit.

whilst it would not be surprising if, by his great ingenuity and skill, he had detected the possibility of removing the obstacles to a cure by division of the tendons. He may have apprehended suppurations and other unfavourable symptoms from the section of so important a tendon as that of the Achilles; or, having been unsuccessful in his first attempts, he may have been deterred from a repetition.

From the period of Hippocrates to the latter part of the last century, but little progress was effected in the treatment of these affections; the principle recommended by each successive author coinciding with that advocated by Hippocrates —the gradual restoration of the form of the foot by mechanical pressure; the improvements merely consisting in the proposal of a variety of methods of applying this principle.

Thilenius is the first on record who proposed division of the tendo Achillis. Being a physician, he did not undertake the operation, but prescribed its performance. He describes* the case of a young lady, aged seventeen, affected with Talipes varus of the left foot, which had continued from her earliest infancy, notwithstanding the application of various bandages, unguents, and the use of different kinds of shoes. He does not relate the principles which induced the recommendation of division of the tendo Achillis; but from the circumstance of his alluding to its great shortening, it may be concluded that this principally influenced his decision. A surgeon of the name of Lorenz divided the tendon in this case, 26th March, 1784, on which the heel immediately descended two inches, enabling the patient to tread on the entire sole. The foot was retained in its improved position

* "Medicinische und chirurgische Bemerkungen," von Moritz Gerhard Thilenius, M.D., Frankfurt a. M. 1789, p. 335. It is remarkable that the relation of this case, so interesting in the present day, was omitted in a subsequent edition of the book published after Thilenius's death.

by appropriate bandages; and the cicatrisation of the "large wound" was complete on 12th May. The cure was so perfect, that the patient walked as well as a sound person.

The unostentatious account given by Thilenius would at the present period have created a greater sensation in the minds of the medical profession than it excited in his time, when, as Stromeyer remarks, the importance of this commencement of improvement in the treatment of an entire class of affections was not so readily perceived or appreciated; the onward impetus of the art of surgery in search of new methods of overcoming disease being now more universally apparent.

The example of Thilenius was followed by Sartorius,* whose mode of procedure is characterised by Stromeyer† as being calculated rather to deter than to serve as a model for imitation. The violence with which, after division of the tendon, he endeavoured to restore the foot to its natural position, is superfluous in the milder cases of Talipes, and ineffectual in the more severe ones: under his treatment the subsequent inflammation of the ligaments of the joint induced ankylosis, neither of which results is ever witnessed when a more cautious method is employed. Stromeyer remarks that, notwithstanding the violent and unscientific nature of the plan of Sartorius, it had nevertheless found imitators since the publication of his own improved method. Stromeyer, in his condemnation of the plan of Sartorius, admires the candour with which the latter depicts the difficulties experienced in the restoration of the foot, but which some of the successors of Stromeyer, in the relation of their cases, have passed over in silence; the chirurgical public having

* Siebold's "Sammlung seltener und auserlesener chir. Beobachtungen," Band iii. p. 258.

† "Beiträge zur operativen Orthopädik," p. 25.

been unnecessarily disappointed in its expectations of the instantaneous results of the operation.*

* The following extract from the report of Sartorius will shew the severe nature of his operation. The patient was a boy aged thirteen; the case Pes equinus, the result of abscesses on the back of the leg six years previously. —"I enveloped the limb with a roller-bandage; applied a graduated compress and tourniquet to the femoral artery. I prepared a table with pillows, and placed the patient on his face, the dorsum of the foot resting on the edge of the table; the requisites for the operation, dressings and bandages, being near at hand, I administered a glass of wine with tinct. opii ɱxv., and seated myself with the foot before me. I made a longitudinal incision, of the length of four inches, with a convex scalpel, through the integuments over the middle of the tendon, carefully dissected off the integument and cellular tissue, exposing the crural fascia, which I punctured for the introduction of a director, on which I divided it to the same extent as the external incision. The labiæ of the wound being held asunder, I passed the scalpel obliquely beneath the tendon, and, turning the edge upwards, completely divided it: the severed extremities receded an inch. The patient was then turned on his back, after which, grasping the foot with my right hand, I moved the ankle-joint, whilst the fore-finger of the left-hand was placed in the wound to ascertain whether, during the attempt at flexion of the foot, the inferior portion of the tendon was farther separated from the superior portion. I was, however, unable to bend the foot more than prior to division of the tendon, of which certain cicatrices near the os calcis, binding the tendon both to the skin and deeper-seated tissues, were the cause. The patient was again placed on his face, and the external incision prolonged as far as the tuberosity of the os calcis; the cicatrices connected with the integuments were divided, and the tendon freed from the adhesions to the deeper-seated tissues; in this situation a steatomatous-looking substance was encountered, instead of adipose tissue. Once more the patient was turned over on his back, when I ascertained that the foot could be bent somewhat further, but that it was impossible to restore the foot to a proper position. But little hæmorrhage took place, only one arterial twig requiring to be secured. I now firmly grasped the foot with both hands, at first extended the ankle, and, with the gradual application of increased force, satisfied myself that it would not easily yield. I then desired the attendants to hold the limb securely on the table, and, with a vigorous effort, employed my entire strength to bend the joint, in which I at length succeeded, but which occasioned such a noise and cracking as if the whole of the bones had been broken; but, on examination of the limb after its replacement, I could not perceive that any

Michälis,* although disapproving of the method of Thilenius, became convinced of the curability of contractures of the limbs by section of tendons, from the consideration of the cure of wry-neck by division of the sterno-cleido mastoideus, and the experiments of Bell on division of Poupart's ligament. He congratulated himself on having effected an improvement by *incision* of the tendon to the extent of only one third of its thickness, instead of performing complete division; the principle on which he acted being that of diminishing the strength of the tendon by incision of part of its fibres. His first patient was a youth aged sixteen, on whose tendo Achillis he operated in November 1809. He describes the cases of eight individuals whom he cured during the same year, three having been affected with Pes equinus, one with Varus, three with contracture of the knee, and one, a female, who had extreme contraction of four fingers. He considered the restoration of the form of the part to be necessary immediately after the operation;

fracture had taken place . . . I must admit that I was very uneasy concerning the probable consequences, as the reduction of the foot could hardly have been effected without laceration of several ligaments of the joint, inasmuch as the foot yielded *suddenly* to the violent force exercised, and occasioned the frightful cracking. I was aware of the serious symptoms accompanying those dislocations of the tarsus and carpus which are combined with laceration of ligaments; and although the case was not a true dislocation, it was with propriety so considered, not only on account of the wound, but from the laceration of numerous ligaments which must necessarily have ensued." Symptomatic fever occurred, and pain in the joint continued for a considerable time; but the suppuration was not extensive. At the expiration of nine weeks the wound cicatrised, complete ankylosis of the ankle having resulted; the patient was nevertheless able to walk with ease, unaided by a stick. Cases X. and XI. in this Treatise, contrasted with the report of Sartorius, illustrate the superiority of the Stromeyerian method of cure.

* "Ueber die Schwächung der Sehnen durch Einschneidung;" in Hufeland und Himly's Journal, 1811, Stück 5.

and in this he states he was for the most part successful. It is therefore apparent that he either entirely divided the tendon, or that he ruptured the fibres remaining undivided; and consequently it is not matter of surprise that the wound did not cicatrise until the expiration of three or four weeks after the operation. The perusal of the paper of Michälis suggests two important considerations: first, that he had never treated any of the severer forms of T. varus, inasmuch as in such cases, from the contracted state of the ligaments of the ankle, immediate replacement of the foot is impossible; secondly, that after simple *incision* of the tendon and rupture of the remaining fibres, he incurred great risk of inducing suppuration and sloughing of the tendon, and inflammation of the joint; especially if he had succeeded in forcibly overcoming the resistance of the ligaments. I was not therefore surprised to hear, from a professor of the university of Berlin, who had witnessed the performance of the operation of incision of the tendo Achillis by Michälis, that Talipes was incurable except by the old mechanical method.

The position of Michälis, as lecturer in a surgical school, afforded a favourable opportunity for the dissemination of his method; but as, from the absence of any public record of cures resulting from its promulgation, it may be inferred that his example was not followed, we may safely conclude that the attendant difficulties and dangers procrastinated the recurrence to the path which the genius of Thilenius had pointed out.

After the lapse of seven years from the publication of the method of Michälis, Delpech* had the merit of reintroducing the cure of Talipes by division of the tendo Achillis. He appears to have been aware of the proceedings of Thilenius only, but became satisfied of the propriety of attempting

* "Chirurgie Clinique de Montpellier." 1823. Tom. i. p. 180.

the operation from a consideration of the speedy reunion that ensues of the tendo Achillis, and of a fractured patella, by a connecting band of lymph on accidental rupture or fracture. He was particularly influenced in this decision by observing that the newly formed tissue uniting these parts, although at first soft, became, after a certain period, capable of resisting the action of the muscles. He conceived the idea that, after division of the tendo Achillis, the substance uniting the extremities might, prior to the acquisition of too great firmness, be gradually elongated by mechanical extension, and entertained no apprehension of injury to the general health from the operation, or ankylosis of the ankle consequent on the replacement of the foot. He therefore determined to retain the limb, after division, in the distorted position occupied prior to the operation, in order that the extremities of the tendon might at first be maintained in close apposition, and also that on subsidence of the inflammation and apparent reunion of the tendon, gradual extension of the intermediate substance should be effected.*

He was not, however, without anxiety lest pain might ensue to such an extent as to defeat the restoration of the foot—that the connecting band might prove deficient in the

* The rules laid down by Delpech (" L'Orthomorphie," t. ii. p. 330) for the operation and subsequent treatment were as follow: 1. The tendon to be divided should not be exposed; its section should be accomplished by a circuitous route, and not by an incision in the skin parallel to its course. 2. The divided extremities should be placed in contact immediately after the operation, and maintained in that state by appropriate apparatus until their reunion is effected. 3. As reunion can only take place by an intermediate fibrous substance (organisation inodulaire), which is capable of elongation prior to its solidification, it should be gradually and carefully extended to a length sufficient to compensate for the deficiency of the contracted muscles. 4. After the completion of this extension, the limb should invariably be fixed in the improved position resulting from the elongation, and be thus maintained until the *new* tissue has acquired the firmness of which it is susceptible.

necessary ductility—or that, after the extension, it might be found too weak to perform the office of the original tendon. He did not allow these apprehensions to interfere with the attempt, justly concluding that, *provided the heel could be depressed, and the patient become enabled to tread on the entire sole, even should the muscles of the calf not recover their natural action, the sufferer would be amazingly benefited.*

Delpech selected a case of Pes equinus in a boy nine years of age, in which he divided the tendo Achillis, May 1816. I detail his method of proceeding, for the purpose of shewing more clearly the great improvement subsequently introduced by Stromeyer. The patient being placed on his face, Delpech passed a common scalpel from within outwards through the limb between the tendo Achillis and the deeper muscles of the leg, the wound in the integuments on each side being an inch in length. On withdrawal of the scalpel, he introduced a convex-edged bistoury, and completely divided the tendon from before backwards, carefully avoiding division of the bridge of skin extending over the space formed by the receded extremities of the tendon. Being anxious to ascertain whether any obstacle to the flexion of the foot still remained, he attempted replacement with his hands, and found that he could bend it to a right angle. It is not surprising that after this method of operating, symptomatic fever, suppuration, and sphacelus of some portions of the tendon and cellular tissues, should have ensued; and that the extension should not have been commenced until four weeks after the operation, at which period the wounds were still uncicatrised. At the eighth week, an indentation, of the length of an inch and a half, was visible at the part where the operation had been performed, and was supposed to indicate the space between the extremities of the divided tendon, the wounds at this time being yet unclosed. After three months

the intermediate substance appeared to be two inches in length, much smaller than the original tendon, but sufficiently firm to prevent flexion of the foot beyond a right angle. The general health of the patient having suffered, indolent abscesses were formed on the inside of the leg, the inside of the patella, and in the inguinal region; and neither these nor the wounds from the operation were healed for some months. The patient was, however, enabled to stand on the limb, and to take exercise, and ultimately obtained a cure. In the year 1836, he was still living, the cure having proved effectual. But when the length of time occupied in the treatment of this case, and the numerous attendant difficulties, are considered, it will not appear surprising that Delpech never repeated the operation, although he still believed that it might occasionally be successfully resorted to.*

To Stromeyer is due the honour of establishing the division of tendons on a secure and permanent basis, and of ensuring its reception as a standard operation in the art of surgery. The isolated efforts of his immediate predecessors had been severely censured by the contemporary medical press of France and Germany, and received no encouragement whatever from any surgical authors throughout the various countries of Europe. Fifteen years had elapsed since the publication of the case of Delpech without any recorded repetition of the operation, when Stromeyer, February 1831, performed division of the tendo Achillis; and in 1833 and 1834 published two memoirs,† detailing the history of six successful cases. Stromeyer not only perceived and acknowledged the value of the rules laid down by Delpech for the performance of the operation, and the soundness of the

* "L'Orthomorphie," tom. ii. § 327.

† "Rust's Magazin," Band 39, p. 195, and Band 42, p. 159. Archives générales de Médecine, tome iv. p. 103.

principles on which he recommended that the subsequent treatment should be conducted; but Stromeyer further discovered the errors committed by Delpech in following out his own principles, and the source of the difficulties encountered by him, and at once devised the means of avoiding them. It might almost be concluded, from a perusal of Delpech's account of the operation, that he had not recommended the first of the rules he has laid down; for after advising that, in order to avoid inflammation and exfoliation of tendon, the latter should be reached with as little exposure and disturbance of the surrounding parts as might be possible, he nevertheless adopted a mode of operation equally calculated to produce the results he deprecated as the single extensive incision of Sartorius. The transfixing the limb, leaving a wound in the integuments one inch in length on each side of the tendon, and the introduction of a second knife for division, followed by the application of pressure to the fore-part of the foot, and forcible flexion, merely for the satisfaction of ascertaining whether the obstacles had been removed by the operation, appear, at the present day, to constitute a most unscientific mode of proceeding. It is true that the limb was subsequently retained in its distorted position, and the divided extremities of the tendon placed in apposition; but the free exposure of the tendon, and the laceration of the surrounding cellular tissue from *immediate* forcible flexion of the ankle, had so far indisposed the parts to union by adhesion, as to induce suppuration, with exfoliation of the tendon, tedious cicatrisation of the wound, and even indolent abscesses in the course of the absorbents as high as the inguinal region,—and thus sufficiently proved the impropriety of this method of operation. Stromeyer, in extenuation of Delpech, states that the patient may possibly have possessed an unhealthy

state of constitution, predisposed to generate symptomatic fever, suppuration, &c., on the infliction of any local injury; and that had Delpech repeated the operation, he would have improved his method; but at the same time observes, that as several hundred cases have since been operated, in which the wound has united by adhesion, it may be inferred that something more than unhealthiness of constitution or idiosyncrasy contributed to produce the difficulties experienced by Delpech.

It is certainly probable that Delpech might ultimately have improved his method of operation; but it is evident that he was unconscious that the difficulties he experienced arose from these sources, and that he apprehended their recurrence, from the circumstance of his neither having repeated the operation, nor having, after the lapse of thirteen years, when he again wrote on the treatment of these distortions,* recommended any other mode of proceeding. The profession ought, notwithstanding, to feel grateful to Delpech for making known his just conclusion on the utility of the discovery of Thilenius, which he not only proposed to imitate, but carried into execution. The rules he laid down served as a guide to Stromeyer; but the merit of the latter is greater, inasmuch as he surmounted the difficulties encountered by Delpech, whose rules for the performance of the operation appeared so consistent with sound chirurgical principles. Had Stromeyer succeeded Sartorius, the severity and violence of whose operative proceeding is calculated to excite a shudder, his improvement might have appeared more the result of a sudden conviction of the exceeding rashness of the method pursued, than that of a scientific train of reasoning.

Stromeyer gives the following description of his manner

* "L'Orthomorphie."

of dividing the tendo Achillis and other tendons: *—"The operation must invariably be effected by puncture, without external incision. A very small cutting instrument should be selected—a small, moderately curved, sharp-pointed bistoury is adapted for most occasions. The limb should be extended, in order to produce the necessary projection of the tendon, when the instrument should be passed behind it, the point perforating the opposite skin; division of the tense resisting tendon being effected rather by pressure of the edge than by its slow and cautious onward movement. The skin, being elastic, yields to the pressure of the knife, the two punctures not exceeding its width. I have frequently divided the tendo Achillis in this manner without producing a second puncture; but this is of little moment, as two minute punctures heal as quickly as a single one. The division of the tendon is known by an accompanying sound, which can scarcely be mistaken. The performance of the operation with the point of the instrument is less to be relied on, partly from its being too weak, and also because the operator can be less certain of not causing injury to other structures in the event of the patient not remaining quiet throughout the operation. . . . . The attempt to commence extension directly after the operation, and the endeavour immediately to restore the limb to its natural position, which will very seldom succeed, and, as the case of Sartorius proves, can only be effected by great force, is neither necessary nor advisable. The commencement of extension before cicatrisation of the wound in the integuments is unadvisable even when possible, as it may produce inflammation and suppuration not confined to the vicinity of the wound; it is unnecessary, inasmuch as the tension of the divided muscle is not restored during the gradual mechanical extension

* "Beiträge zur operativen Orthopädik," p. 17.

applied subsequently to the healing of the wound, but occurs after the complete reunion of the tendon and after the necessary motions of the limb during exercise have acted as a stimulus to its contractility. . . . The alteration in my method proposed by Bouvier as an improvement, viz., the replacement of the foot immediately after the operation, must, with the greater justice, be regarded as a retrograde progress, from its having constituted the plan of my predecessors." Stromeyer then ridicules the idea of the improvement asserted to have been effected by Bouvier's introducing, under the denomination of a needle, the small sharp-pointed bistoury employed by himself; and proceeds: "The assertion of M. Bouvier and Mr. Whipple of Plymouth, that the extension is more painful when effected after the healing of the wound, is entirely imaginary; as the pain so produced is never referred by the patient to the divided part, but to other tissues still resisting the extension—the tibialis posticus and peronei muscles, and the posterior ligaments of the joint."

Since the announcement of the labours of Stromeyer, the division of the tendo Achillis has been performed in almost every country in Europe, and also in North America, with the triumphant success ensured by the simplicity of the plan recommended by him; and the publication of several treatises in Germany and France, besides numerous contributions in periodicals, evince the eagerness with which information on this subject has been desiderated. Most of these authors have assumed the credit of improving the method of Stromeyer:—the position of the patient,—the shape of the knife, whether curved or straight, pointed or obtuse, whether the edge be convex or concave,—the distance from the heel at which the operation should be performed,—the manner of severing the tendon, whether accomplished transversely through it, or obliquely, whether from behind forwards, or

the reverse,—the construction of the extending-apparatus, —and the period for commencing the extension;—these matters have all afforded opportunity for the development of the ingenuity and skill of the practitioner. I cannot, however, discover that since the improvements of Stromeyer any great addition has taken place with reference to these points. There has indeed been no improvement of the principles laid down by Delpech; the value of which was first satisfactorily demonstrated and practically illustrated and enforced by Stromeyer. But there has been a departure from these principles, which Stromeyer has justly designated a retrograde progress.

Every surgeon will place his patient in the position which best accords with his particular dexterity or his personal convenience: in the adult, if the surgeon propose to divide the tendo Achillis alone, he may prefer the sitting posture; if more than one tendon require division, the recumbent. Children or nervous patients may be placed with advantage on the abdomen, unless operation on other tendons be necessary.

An absolute rule respecting the distance from the malleoli at which section of the tendo Achillis should be performed cannot be given, as it must vary according to the degree of elevation of the heel; the insertion of the tendon should perhaps serve as a guide, in which case a position about an inch above the extremity of the os calcis will generally be found the most convenient; or the spot where the tendon is most prominent may be selected.

The shape of the small knife employed in the performance of the operation is of little moment to the surgeon of ordinary skill, provided he succeed in division of the tendon by puncture, with the observance of the essential rule of injuring the surrounding parts as little as possible.

The most simple, secure, and certain mode of severing the tendo Achillis, is first to apply the edge of the knife to the anterior surface of the tendon, cutting from the deeper-seated tissues towards the integuments. The proposition to divide the tendon in an oblique direction, in order that larger surfaces may be presented for the effusion of the uniting medium, and firmer reunion of the tendon be ensured, has resulted rather from mechanical ideas of the mode of reunion of divided tendons than from practical observation or physiological reasoning. I have invariably performed the transverse division, and in every instance the tendo Achillis has united by a band as firm and large, and sometimes even larger, than the original tendon; the spot where the operation has been performed is frequently imperceptible (see p. 30). The experiments of Von Ammon, Günther, and Bouvier, on dogs and horses, have demonstrated that reunion of tendons, by a strong ligamentous or semi-cartilaginous band, takes place, in whatever manner the division be effected, and whether the ends be maintained in apposition, or at a distance, resulting from contraction of the muscle, or even when portions are removed.

The construction of the apparatus to effect replacement of the limb is the more fertile source of improvement; and in proportion as the surgeon extends the operation beyond the simpler forms of distortion, the resources of mechanical skill become more available. Stromeyer recommends practitioners who have not had experience in the treatment of distortions by division of tendons, to select at first cases of T. equinus, and not to attempt the cure of the more severe distortions until considerable tact is acquired in the mechanical part of the treatment; and that when accustomed to a particular apparatus, success will be probably better ensured by an adherence to its use,—as it more frequently depends

on the manner of application than on the apparatus itself.* It is certain that one individual may admirably conduct the mechanical extension with the same means which in the hands of another may be wholly inadequate; and that apparatus will therefore generally be selected which is most consonant with the ideas entertained of the best means to promote the object in view.

The real improvements which have been effected since the announcement of Stromeyer's success consist in the more complete definition of the anatomy, pathology, and varieties of Talipes; in the demonstration of the certainty of cure in a larger proportion of the severer forms of distortion; and also in some additions to the apparatus: but to the merit of these improvements Stromeyer may assert a direct claim to a considerable share. The candour and ability with which he published the entire nature of his mode of proceeding, faithfully depicting both his successes and attendant difficulties; the persevering assiduity with which, notwithstanding the opposition of his contemporaries,† he continued for two or three years to multiply instances of the value of the division of tendons, before his example found imitators, as justly entitle him to the gratitude of the profession, as they will ensure him honour from posterity.

* It may be here observed, that in descriptions of the merits of a particular apparatus, and in eulogising its superiority, the author should invariably accompany his description with a representation, to enable the reader to form an opinion.

† Professor Blasius, who severely criticised Stromeyer's revival of division of the tendo Achillis, has since made most honourable amends, by approving of the method in his translation of my former Dissertation—("Analecten der Chirurgie.")

ON CLUB-FOOT

AND

ANALOGOUS DISTORTIONS.

Although an inquiry into the mode of curing the diseases in question is the paramount object of this treatise, yet, as I consider that some account of their symptoms, morbid anatomy, and nature, will elucidate the propriety of resorting to the particular plans of treatment which I have to describe, I shall commence by enumerating the symptoms of the diseases included under the term of *club-foot;* and afterwards consider the morbid states of the parts involved, deducing from them the pathology, not only of club-foot, but of a numerous class of analogous affections of various parts of the body.

The term club-foot has been indiscriminately applied to three kinds of deformity, to which surgical writers have affixed the terms *varus, valgus,* and *pes equinus;* and the ordinary laconic description of their symptoms has not usually extended further than stating, that in varus the toe of the affected limb is twisted inwards, so that the patient walks more or less upon the outer ankle; that valgus is the contrary deformity, the toe being turned outwards, and the patient compelled to tread upon the inner ankle; and that the pes equinus is that state of the foot in which the individual rests the weight of the body upon the toes only.

So long as a foot, altered in its form according to any of these different types, was looked upon as a shapeless mass, an organ deficient perhaps in some of its parts, and requiring for restoration to a more natural figure, to be merely moulded and compressed by mechanical instruments for a considerable length of time (the case being considered incurable if these means did not succeed), that brief definition

of symptoms, and the nomenclature commonly used, appeared sufficient. But as chirurgical means of overcoming these deformities have been discovered, a more strict description of their symptoms is necessary to distinguish the cases which are fitted for operation from those which are curable without an operation, or from others which are incurable by any means. The nomenclature, for the same reason, has appeared to me to require some additions; the causes and varieties of deformities of the feet being numerous, the three names, varus, valgus, and equinus, are insufficient to designate them. I have therefore proposed to employ the classical word *Talipes* (hitherto applied to one species only), as a generic term, to include all those deformities of the feet produced, as will be seen, by contraction of certain muscles, to restrict it to deformities from this source; and to use the terms varus, valgus, and equinus, to designate the specific forms of these diseases.

The most simple of these deformities is the Pes equinus,

Fig. I.—*Congenital Talipes equinus in a youth aged 14 years.* (Case II.)
The deformity of this foot, and of every T. equinus figured in this work, appeared much *greater* in the act of walking than represented in the drawings, owing to the toes then turning a little inwards, and from the individual wearing a high-heeled boot, having a clumsy appearance.

or, as I have designated it, Talipes equinus. It is that contracture of the limb, where the individual walks solely upon the point of the foot, upon the toes, or upon the ball of the foot; without the heel or any of the posterior part of the sole touching the earth. The heel may be more or less elevated from the ground, from half an inch to five or six inches, according to the different degrees of severity of the disease.

FIG. II.—*Non-congenital Talipes equinus in a youth aged* 11. (Case III.)

There is also great variety in the manner in which the individual treads, as the weight of the body may be borne either upon the front part of all the metatarsal bones, which constitutes a pure case of Talipes equinus; or the person is inclined to tread more upon the little toe, or upon the great toe, when the deformity approaches the other forms of disease hereafter to be considered. Most frequently in such cases the ball of the little toe bears the brunt of the pressure of walking, from the toes becoming thrust a little inwards (see Appendix, Cases III., VII., VIII., XII.).

The most common form of club-foot is the Talipes varus, —that in which the patient is said to walk upon the outer ankle, the toe being turned inwards. It is that deformity

in which the foot from some cause undergoes a threefold alteration of its position in relation to the leg—extension, adduction, and a rotation of the foot, somewhat analogous to supination of the hand, taking place to a greater or less extent according to the severity of the disease. The heel is

Fig. III.—*Example of congenital T. varus affecting both the feet of a child aged* 20 *months.* (Case XVI.)

drawn upwards (extension), the toe is turned inwards (adduction), and the patient treads upon the outer edge of the foot only, the inner edge being raised from the ground (rotation). This threefold alteration from the natural position of the foot occasions the most serious impediment to steady or comfortable walking; and when the disease reaches the higher gradations, the foot assumes a frightfully distorted appearance (see figs. 5 and 6).

Valgus, or Talipes valgus, is a much more rare affection than either of the preceding. It may be regarded as the opposite state to T. varus, and, like it, consists of a threefold alteration of the position of the foot, there being partial bending of the ankle, *ab*duction, and a rotation of the foot; but this rotation takes place in the opposite

direction to that in Talipes varus, as in T. valgus the external *edge* of the foot is removed from the ground. The rotation in a complete case of T. valgus is so great, that the patient in the act of walking does not touch the ground with any part of the sole of the foot, but treads entirely upon the inside of the instep and upon the malleolus internus. In short, the sole of the foot is directed completely outwards and a little backwards, the ankle is held in a state of semi-flexion, the anterior half of the foot (the metatarsus and toes) not touching the ground.

FIG. IV.—*Front view of a congenital Talipes valgus of the right foot of a boy aged four years.* (Case XXVIII.)

d a, the outer edge of the foot raised from the ground.

e, the great toe raised from the ground, although the internal edge of the foot is directed towards it.

b, the internal malleolus; and *c*, the internal extremity of the navicular bone; being the parts upon which the patient walked.

In each of these three forms of disease, Talipes equinus, T. varus, and T. valgus, the surgeon is enabled, in the majority of cases which come under his notice, temporarily to reduce the foot to a more natural position with his hands, except in cases of long standing, or in those of adults, in which all the tissues are usually too rigid for the manual

exertion of the surgeon to stretch and elongate them. This manipulation of the limb will, however, inform him of the nature of some of the obstacles which oppose the restoration of the foot to its proper position. In the Talipes equinus and T. varus, he will feel the tense tendo Achillis resisting his efforts to bend the ankle-joint; in the T. varus, he will, according to the stage of the disease and the state of the limb as respects the quantity of its adipose tissue, feel, and occasionally see, the contracted tendons of the tibialis anticus and tibialis posticus muscles; in both diseases he will often notice the contracted state of the whole of the muscles of the sole of the foot and of the tendon of the long flexor muscle of the great toe; nor will the elongated tendons of the muscles situated on the front of the leg, not hitherto mentioned, escape his observation. From the long extensor muscle of the great toe and those of the other toes being kept upon the stretch through the causes which maintain the anormal position of the foot, the toes, particularly the great toe, are held in a state of semi-extension (see figs. 10 and 11).

The tendons which in Talipes valgus are felt to obstruct the restoration of the foot to its natural position, are, as far as my experience has hitherto extended, chiefly those of the peronei muscles. In a case of congenital T. valgus at the age of four years (Fig. 4), which I have recently operated with success, but only the second case of true Talipes valgus which has been presented to my observation during the last two years, although more than a hundred instances of the other two forms of Talipes have passed through my hands within the same period,—the tendons of the contracted peroneus longus and brevis muscles had been felt very prominent from the time of birth. Owing to the alteration which had been effected in the relative position of the bones which enter into the composition of the ankle-joint and tarsus, the tendo Achillis deviated outwards from its usual direction, similar to the tibialis anticus in some cases of T. varus, offered a strong resistance to replacing the foot, and was consequently divided.

The general condition of the limbs affected with either of the three forms of Talipes is the same; yet it offers a remark-

able contrast with that of a sound limb. The legs are often shorter in proportion to the stature of the individual, and the feet usually smaller. I have sometimes found, when one limb only is affected, that the difference in the length of the extremities amounted to as much as four inches; it varies between that extreme and a half or a quarter of an inch, according to the age of the patient, increasing with the advance towards puberty. The bones in these cases are generally shorter, and more slender than in a natural foot. The thigh occasionally participates in the shortening, and its muscles are invariably weaker in the case of a single Talipes than are those of the sound side. The deficiency in the development of the muscles of the leg is, however, much more striking; those of the calf and of the front of the leg, the outline of which can be examined, being frequently not one-third the ordinary size. In infants and very young children the small size of the muscles is often less apparent, owing to their members being more thickly encased in adipose tissue.

The mode of progression necessarily adopted by those persons afflicted with the various forms of club-foot, is not only disagreeable to the eye of the casual observer, but often painful and extremely laborious, even when only one limb is affected. By dint of long practice, many are enabled to balance their bodies tolerably well in walking, although the base upon which the weight of the body is borne is so much smaller than that afforded in the natural state by the *soles* of the feet. In order to compensate for deficiency in this respect, they usually stand with the extremities widely separated, and use the arms as a means of balancing the trunk. But few are enabled to take long walks without considerable bodily fatigue, in consequence of the inordinate exertion they are compelled to undergo, and the pain induced in those parts of the foot on which they tread so unnaturally. These parts are frequently protected to a certain extent by thickenings of the cuticle, corns, and bursal and adipose swellings, which are formed through the constant friction and pressure to which they are exposed (figs. 5 and 6).

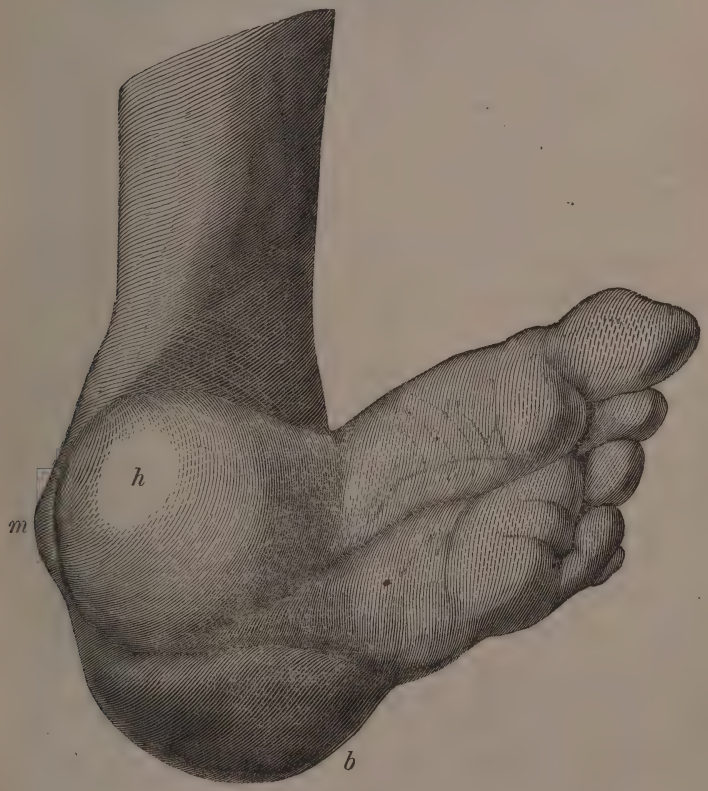
The deformity of the ankle is often complicated from contracture of the knee. The most important function of the muscles of the calf when in a state of healthy activity, is to extend the foot by drawing the heel upwards; but as the gastrocnemius externus, forming so large a portion of these muscles, is attached to the back part of the inferior extremity of the thigh bone, the knee may become bent by the agency of their combined action. When these muscles are affected by an extreme degree of contraction, of whatever nature, or when the gastrocnemius externus is particularly

FIG. V.—*Front view of an adult congenital T. varus.* Shewing the deformity of the tarsus and the swelling (*b*) which result from the attrition to which the back of the instep is subjected; *h*, the heel; *m*, the malleolus externus. A similar deformity of both feet existed in the subject from which the drawing is taken.

involved, and the foot held in a state of extension, the ankle is not only distorted, but the knee becomes bent from the same cause.

In the majority of cases of Talipes in which the knee is bent while the patient is in the erect posture, it can be straightened when he is seated, as the stress maintained upon

FIG. VI. *represents the same foot as fig. 5, in the reverse position.* In this example of the highest grade of deformity, the sole of the foot is completely vertical, instead of horizontal. The letter *h* indicates that surface of the heel which in the natural state of the foot would touch the ground, whereas it is here presented directly backwards; *m* is the malleolus externus; *b*, the tumor formed of successive layers of thickened cuticle, cutis, and thickened adipose, ligamentous, and periosteal tissues, constituting a cushion on which the patient walked. The outline of this tumor is seen to be better defined upon the posterior aspect of the foot than upon the anterior aspect.



the gastrocnemii when the weight of the body is thrown upon the toes is then removed. The degree of tension exercised on the contracted muscles of the calf when the patient stands erect, is relaxed in the sitting posture, which causes the knee to become straight. But on attempting to straighten the knee when erect, the elevation of the heel is proportionally increased. I have, however, treated a case of T. equinus (see Appendix, Case IX.), in which the contracted state of the knee and ankle existed conjointly in every posture. The contraction of the gastrocnemius externus muscle was in this instance so great, as not only to cause a permanent elevation of the heel to the extent of several inches, but likewise to retain the knee bent at a considerable angle in every position of the body.

Another complication which occurs in Talipes, is an unnatural inward or outward rotation of the thigh, and consequently of the entire extremity. This arises from an inequality in the power of the adductor and rotator muscles of the thigh, and is probably an affection of those muscles analogous to that of the muscles of the leg implicated in Talipes. I shall in this place omit any further description of the symptoms which characterise the different species of Talipes; and refer those who desire a more copious account to my published dissertation upon this subject, and to the cases hereafter related.

The next part to be considered is the morbid anatomy of the different forms of Talipes. So little that is correct has been published upon this head, except that given to the world by Scarpa, that I shall not occupy the time of my readers with any relation of what had been done previously to my own investigations. I shall therefore state, as succinctly as possible, those morbid alterations which I have found to be peculiar to Talipes, after a numerous series of dissections.

The ordinary form of the foot affected with T. equinus suggests at once to the anatomist that this disease cannot be accompanied by any great deviation from the natural form and arrangement of the bones of the tarsus. This supposition is corroborated by observation: a preparation,

belonging to the museum of the London Hospital, consisting of the bones of a Talipes equinus of a young man, shews the deficient development of the osseous framework in all its parts, but no positive displacement or dislocation of any particular bone. Owing to the extended position of

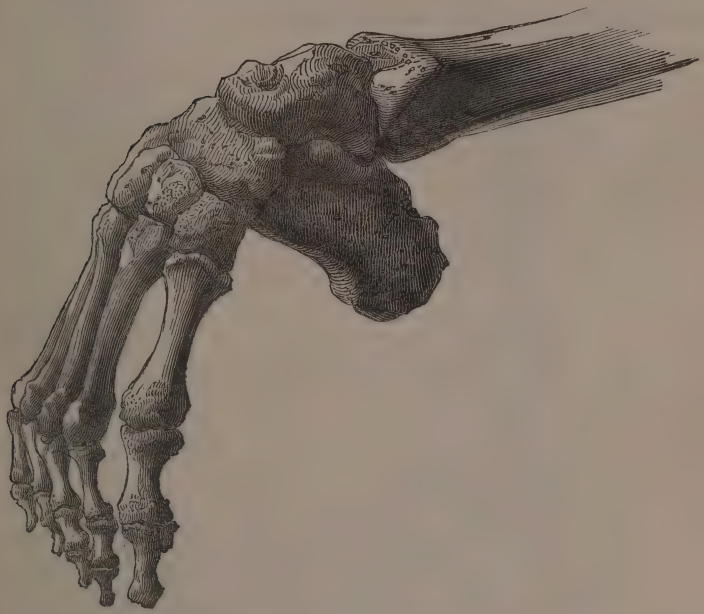


Fig. VII.—*The preparation of T. equinus alluded to in the text. It will be observed that the toes are not extended as in Figs.* 1 *and* 2. *This depended, probably, on the subject of the preparation never having placed the foot to the ground, as he had walked on the knee, with the assistance of a wooden leg. It happens occasionally, however, in T. equinus, when the anterior extremities of the metatarsal bones are drawn to a great extent towards the under part of the os calcis, that the individual walks on the dorsal surface of the metatarsus and toes instead of on their plantar surface.*

the foot, the surfaces of the astragalus which should articulate with the tibia and fibula are exposed upon the dorsum pedis, and, as well as the articulating surfaces of the tibia and fibula, have lost much of their natural smoothness in consequence of little or no motion having taken place between them. The os calcis during life-time had been drawn so much upwards behind the tibia as to have touched it; owing to which

a new articular surface is visible upon the superior part of the calcaneum, close to the articular surface for the astragalus. The dorsum pedis is much more convex than in a natural foot, owing to the scaphoid, together with the cuboid, cuneiform, and metatarsal bones being drawn towards the sole; hence the round head of the astragalus is exposed, instead of being covered with the hollow of the scaphoid bone, as in a healthy state.

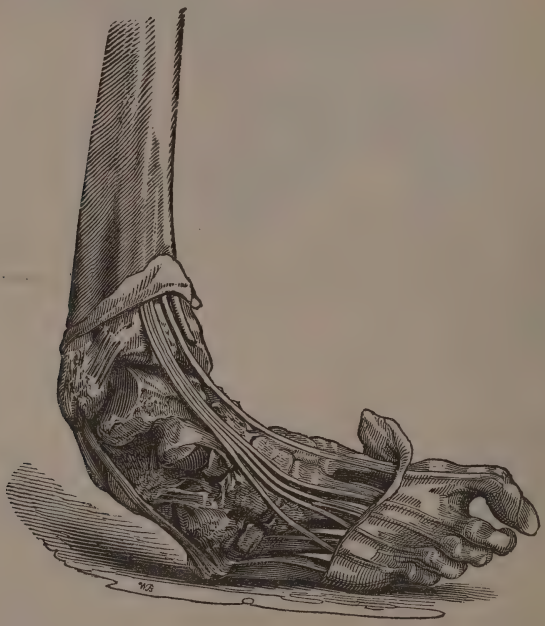


FIG. VIII.—*This drawing represents the preparation of the bones and muscles of the right foot of an adult female affected with Talipes varus.* It may be relied on in the study of the anatomical characters of this disease; as, from the evaporation of the spirits of wine from the jar in which it had been preserved undissected, it was completely dried up, resembling the foot of a mummy. Owing to this unexpected but fortunate circumstance, I was enabled (by soaking the external part of the foot in warm water, and by subsequently removing as much of the shrivelled skin and fascia as was necessary,) to expose the bones for examination without the slightest alteration of the relative position of those of the tarsus having taken place since death.

I have found the alteration in the position of the bones in T. varus to be more complicated than in T. equinus,

which might have been expected on a comparison of the symptoms of the two diseases in the living subject. Talipes varus presents us with all the anatomical characters of the T. equinus, with the addition of others which depend on the adduction and rotation of the foot. The os calcis is drawn upwards; the tibial articular facets of the astragalus and its round head are exposed upon the dorsum of the foot (figs. 8, 9, and 11); but the scaphoid, cuboid, cuneiform, and metatarsal bones are not merely drawn towards the sole, but also inwards and upwards, so that the innermost point of the navicular bone occasionally touches the internal malleolus, and has an articular surface formed on it, occasioned by constant friction (see fig. 8). The superior or external surface of the os cuboides is somewhat separated from that of the os calcis; whereas the plantar surfaces of these two bones are turned towards each other, leaving a triangular space between them externally. The course of the tendons of the muscles situated upon the front of the leg is consequently much altered. Those of the tibialis anticus, extensor proprius pollicis, and ext. long. digitorum, more particularly the first of these, are deflected so much internally, after passing over the ankle-joint, as to serve by their action to increase the deformity in the living subject (see fig. 8).

Such are the essential anatomical characters of Talipes varus, deduced from an examination of nearly thirty specimens in various grades of the disease, according to the severity of which, either of the characters before mentioned may be more or less distinctly traced. I have purposely omitted all the non-essential phenomena met with in the examination of these feet, such as osseous vegetations, and evidence of former caries of the surface of those bones which have suffered from pressure against the earth; and some other still greater mal-positions of the tarsal bones, likewise the occasional result of external pressure and injury from walking, or from wearing improperly adapted mechanical instruments.

I have been afforded only three opportunities of investigating the morbid anatomy of T. valgus; these were furnished

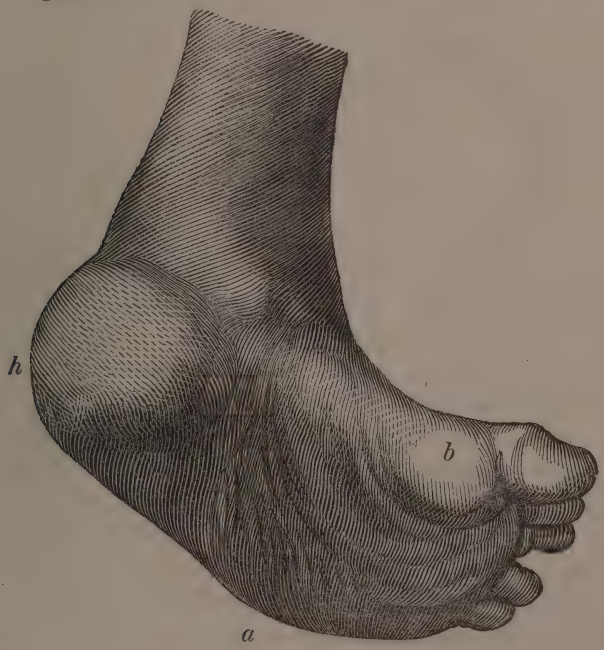
by Professor Müller, and Dr. Pockels of Brunswick. The subjects from which the preparations were taken were full-grown fœtuses. In these, so far as the incomplete development of the osseous structures enabled me to judge, the astragalus was twisted in such a manner, that the articular facet which ought to be applied against the inside of the internal malleolus did not enter the composition of the ankle-joint, but was turned downwards; the navicular bone and calcaneum followed the astragalus, and, together with the internal malleolus, would have touched the ground by their internal surfaces, had the feet belonged to subjects who could have walked. The external edge of the os cuboides and fifth metatarsal bone and external surface of the calcaneum presented directly upwards; the latter, there-

FIG. IX.—*Congenital Talipes varus in a youth aged* 16. This drawing shews that those points of the bones of the tarsus which appear in the dissected foot to project unnaturally, may also be occasionally seen projecting through the skin on the instep. (Case XIII.)

fore, was in contact with the external malleolus, the prominence of which could not be felt through the skin of the foot.

In considering the pathology of Talipes, or the causes which produce, and those which maintain, the deformity of club-foot, I shall omit specifying the opinions of the majority of those who have preceded me in the investigation of

FIG. X.—*The same foot as the preceding, viewed from behind.* It exhibits the state of extension of the foot; the approximation of the heel, *h*, towards the ball of the great toe, *b*; and the unnatural concavity of the sole, the latter being produced by the contraction of the tibialis posticus, flexor longus pollicis, and the muscles of the sole. The letter *a* in this and in fig. 9 indicates that portion of the outer edge on which the individual trod on first placing the foot to the ground; but when in the act of walking he attempted to throw the weight of the body upon the limb, the toes were thrust more inwards, and the tarsal bones outwards; by which means the various eminences seen (fig. 9) on the outer surface of the tarsus were brought in contact with the iron worn upon the outside of the limb. In consequence of their exposure to considerable friction, they were covered with indurations of the cuticle. Both feet were affected in a similar manner, but the left foot to a greater extent.



this subject; and content myself with simply describing the various conditions on which I believe the disease to depend. The conclusions at which I have arrived upon this head are partly derived from the opinions of Rudolphi, Jörg, and Stromeyer, and partly from my own investigations into the symptoms and morbid anatomy of the disease.

Instead of club-foot being considered, as it really is, a mere distortion of parts originally well formed (whether occurring in the fœtal state or subsequently), the popular notion is, that it depends on a deficiency of some of the parts of the limb; that it is a *malformation*, a *monstrosity*, a *lusus naturæ*, or an *arrêt de développement*. This, like other almost equally obsolete opinions of the medical profession, has obtained a firm hold of the minds of the public, and will retain it for generations after the advance of science has introduced other explanations of the nature of the disease. Believing, also, that it is solely a misfortune afflicting the infant anterior to birth, its production has been attributed, like that of other so-called malformations, to some occult maternal influence acting upon the embryo —to the strange ideas and freaks of imagination which have been supposed occasionally to affect the pregnant woman.

Many women who have borne children afflicted with Talipes suppose that the cause of the deformity has been an ordinary fright received during pregnancy; others assert their conviction that a more alarming fright, consequent on having seen, or having dreamt of seeing, a person affected with a similar deformity, has produced the misfortune of their infant. I have, however, been informed by the more sensible, better educated mothers who have brought children affected with club-foot to me, that they neither recollected having had any particular fright, nor having been shocked by seeing distortion in any person during their pregnancy. But I have met with one exception, in the case of an accomplished and talented lady, the wife of a gentleman holding a prominent public situation. She distinctly recollects, during pregnancy, having seen with pity a suffering mendicant similarly deformed; but she

does not attach to the circumstance the importance usually attributed by mothers.

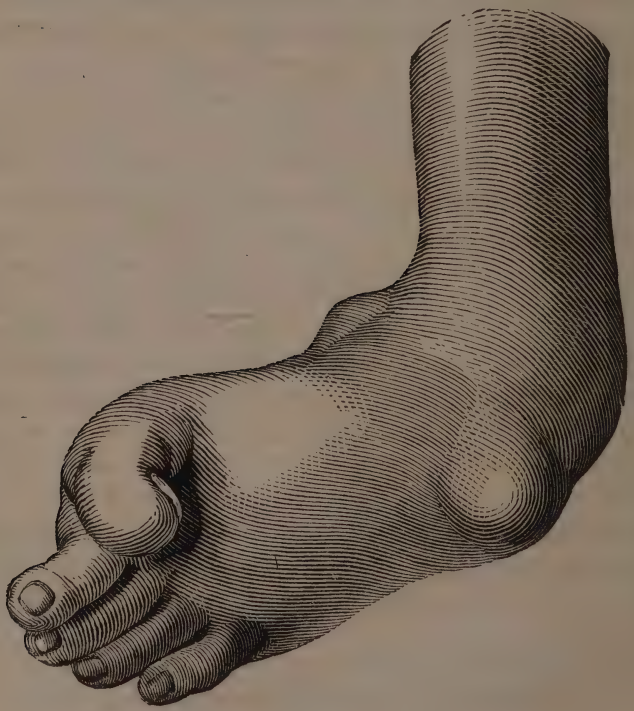
It being natural that a sensitive or sympathising female should not witness misfortune without shuddering, more particularly when pregnant, and as club-footed persons are numerous in our streets, it is not surprising that a woman, on giving birth to a child afflicted with so great a calamity, should recollect having received a fright from this cause. Hence a number of such instances, however commonly received may be the opinion, tend little to confirm the idea that infants become thus affected because the parent had been shocked at the sight of this deformity. The opinion that a severe fright from any *ordinary* cause is capable of inducing club-foot in the fœtus, is more reconcilable with the theory of the formation of this deformity, as will be hereafter explained.

External injury to the limbs during fœtal existence—such as pressure by the parietes of the womb, or the limbs becoming entangled, and compressing each other,—is the next cause more generally admitted as the source of these deformities. But I must briefly dismiss the consideration of this alleged cause. It will suffice to inquire—even if the relatively large quantity of liquor amnii in which the fœtus is submerged did not, at the early period of uterine existence at which these deformities are to be found, oppose an effectual obstacle to the exercise of pressure upon any portion of the fœtus apart from the remainder,—how it is possible that pressure of the walls of the uterus—a mechanical cause acting from without—should affect the fœtal limbs, by disturbing the arrangement and development of certain bones and muscles according to certain invariable rules, instead of acting in an uncertain manner, as external mechanical agents always act when brought in collision with the living body. It is more in accordance with pathology to search for some cause resident within the organisation of the fœtus.

The circumstance which throws most light upon the nature and cause of club-foot, combined with a knowledge

of the morbid anatomy of the disease, is, that it very often takes place after birth and at various ages—most frequently during childhood, from the age of a few months to three or four years; that in these non-congenital cases it presents the same inflexible and essential characters as the congenital

FIG. XI.—*The left non-congenital Talipes varus of a lad aged* 16, *in whom both feet were similarly affected.* The disease commenced in infancy, was accompanied with contracture of the knees; but the deformity did not attain the degree here represented until he had a severe attack of fever, in his eleventh year. He had never been able to walk, in consequence of the contraction of both the knees and ankles: thus, the feet presented pure specimens of non-congenital T. varus, from the anormal position of the bones of the tarsus having undergone no increase by the action of walking. The muscles had been able (unchecked by remedial means) to exercise their full power of producing deformity. The globular prominence visible upon the instep, arises from the exposure of the round head of the astragalus, the navicular bone having been drawn from it both inwards and upwards.



affection; that it advances nearly to the same grade of deformity, and is remediable by the same means. An ignorance of this fact on the part of the majority of those who have written upon the subject, and the circumstance of the morbid anatomy having been little attended to by writers, with the single exception of Scarpa, sufficiently account for the conflicting opinions concerning the nature and causes of the disease. (See figs. 11 and 12.)

A child, during the progress of dentition, whether or no symptoms of disturbance of any of the functions of the nervous system may have been previously shewn, is observed "slightly to drag one leg (and sometimes each leg) after

Fig. XII.—*The posterior view of the foot represented* Fig. XI.

him,"—in other words, does not possess the full voluntary power of moving it; or the parent may notice that the child has a slight limp in his gait, depending, although the cause may be overlooked, on a slight rigidity or contraction of the muscles of the calf, and consequent stiffness or inability of completely bending the ankle-joint. The former case arises from partial paralysis of some of the muscles of the leg, usually those situated on the front, denominated flexors of the ankle-joint; the latter from inordinate or spasmodic contraction of other muscles, usually those on the back of the leg, the so-called extensors of the foot. The disease, from whichever of these two causes it may arise, advances unchecked by *medical* treatment, and the result is the same, the heel being permanently raised from the ground, constituting Talipes equinus; or the toe being drawn inwards at the same time, producing Talipes varus.

In other cases, during the period of life when the nervous system is even more predisposed to suffer from affections of its own tissue, or from diseases in distant organs, a child—borne down by the severity of an attack of scarlet fever, or measles, or by a rapid succession of several infantile complaints, or during an attack of spasmodic croup (laryngismus stridulus),—has what is termed by the parent a fit, owing to which he is said to have lost the use of one or all of his limbs. This loss of the use of the limbs is of two kinds—*paralytic*, in which case it is very often paralysis of some or all of the muscles of one side, but most commonly paralysis of one or both of the lower extremities; or it arises from the seizure of some of the muscles of the extremities with involuntary, tonic contraction—*spasmodic* loss of the use of the limbs. Again, this spasmodic affection of the muscles may affect even the trunk, in addition to the limbs, giving rise to deformity of the spine. Sometimes the loss of the use of the limbs has occurred during the comatose stage of fever; and on recovery, the inability to stand or walk is very reasonably attributed to general debility. But whilst "strength" may be recovered in every other part of the frame, the patient continues

unable to place the heel or heels upon the ground (T. equinus), or that symptom is conjoined with a turning inwards of the toe or toes (T. varus). I have not yet seen Talipes valgus produced after birth from these causes; but I nevertheless expect, from analogy, to meet with it.*

The lameness, whether arising from paralysis of some of the muscles, or from the involuntary contraction of others, is usually accompanied with a diminution of the entire vital energies of the limb, which proves that the organic system of nerves has also suffered—its temperature is often below the natural standard; the muscles either waste, or, with the bones, cease to grow as rapidly as those of a sound limb; the ligaments even do not evince their proper firmness—for instance, the knee, provided none of the muscles of the thigh be affected with spasm, admits of more lateral motion than in a natural state. Talipes is not only thus produced in persons of tender age, but likewise at a later period of life, and even after the age of puberty, in those whose nervous system is equally susceptible of disease. I have witnessed the formation of perfect cases of club-foot,† through spasm of the gastrocnemii and anterior and posterior tibial muscles, in hysterical young women, who had previously enjoyed the perfect use of their limbs. (See Case XXV.)

Let us more fully consider those non-congenital contractions of the feet which depend on derangement of the nervous and muscular systems, and ascertain in what manner a permanent deformity arises. In the first place, we will take a case originating from paralysis of the *anterior* tibial muscles. Here the remote injury, the cause of paralysis, is the same as that of paralysis of other parts of the body; namely, inflammation and the effusion of blood, or

* Since this sheet has been in the press, my anticipation has been realised, as a case of Talipes valgus, arising from paralysis during dentition, has been placed under my care. It perfectly resembles the congenital case represented page 5.

† Can so unclassical a term be applied to a disease of a limb occurring in a young adult female? and if not, need we, in order to designate the congenital cases, longer use a term which persons of nearly every class appear disposed to repudiate?

sero-sanguineous or serous fluid, in some part of the brain or spinal cord, which compresses or otherwise injures the delicate texture of that part of the nervous centre whence the affected muscles derive their nerves. The *posterior* muscles of the leg (those of the calf in particular) having lost their natural antagonists, become firmly and permanently contracted, by the constant action of their involuntary contractile power, by which the heel is raised from the ground, constituting Talipes equinus. At an early period of the disease, this contraction may be overcome by forcibly bending the foot with the hand; but this after a time becomes impossible. (Cases I., III., IV., XXX.)

The other case, that of a Talipes originating from spasm, admits of a different explanation. The remote cause resides either in the central organs of the nervous system (most probably in the spinal marrow), or it is a disease existing in some other organ of the body, affecting peripheral parts of the nervous system; for instance, in some one of the viscera of the chest or abdomen, more probably of the latter. From this an injury is propagated to the central organ, and is reflected to certain muscles of the leg, which become spasmodically contracted. In other words, there may be either some deviation from the healthy state in a part of the spinal marrow, where the roots of the motor nerves distributed to the muscles of the calf are implicated or irritated, causing them to become involuntarily contracted; or there may exist elsewhere some disease, such as an irritation of the mucous membrane of the alimentary canal by improper or undigested food or worms, through which filaments of nerves (named by Dr. Hall *incident*) are excited. These communicate in the spinal cord with other filaments — the *reflex*, or involuntary motor nerves, whereby the muscles of the calf are excited to spasmodic action.* (Cases VII., XII.)

In this explanation of the production of a non-congenital Talipes, I have confined myself to the most simple and intelligible form of the Talipes equinus. The T. varus

* For a further explanation of these phenomena, I again refer to my published dissertation.

differs only in depending on paralysis or spasm of a larger number of muscles. When paralysis is the cause, the peronei muscles have lost their power, as well as the anterior tibial and long extensor muscles of the toes. (Cases XX., XXII.) If spasmodic contraction be the cause, the posterior tibial muscle, long flexor muscle of the great toe, those of the sole of the foot, and sometimes the tibialis anticus muscle, are partially involved in the production of the deformity. (Cases XIV., XXI., XXV., XXVI.)

Contraction of some of the muscles of the arms is not uncommon, produced after birth, and arising from the same causes described as inducing deformity of the feet. I have met with two instances of its existence, where there was no analogous contraction in the foot; but I have treated several others in which Talipes existed in conjunction with distortion of the hand, exactly resembling the *club-hand* with which infants are sometimes born. (Case XXI.)

I have here defined the manner in which I consider Talipes to arise after birth. Any cause, whether paralytic or spasmodic, by which the equilibrium between different sets of muscles, that are naturally antagonists, is disturbed, produces the distortion vulgarly called club-foot. Other causes, viz. those which produce a shortening of the muscles and other soft parts upon one side of the leg, by disturbing, although in a different manner, the antagonism of the muscles, are capable of producing deformities similar to those belonging to the genus Talipes. I have had under my care two examples of the ankle-joint rigidly fixed in the extended position; in one instance the heel having been raised three inches, and in the other from five to six inches, in consequence of the contraction of numerous cicatrices on the back of the leg, resulting from the healing of abscesses, accompanied with loss of substance through sloughing and necrosis.* Another cause of the shortening of the muscles on the back of the leg arises from the long confinement of patients to bed, during the union of some kinds of fractures, or during the reparation of other injuries. I have also met

* See Appendix, Cases X. and XI.

with a case of permanent elevation of the heel produced by the ankle-joint having been too tightly secured by mechanical apparatus, and continued too long in the extended position, for the union of a ruptured tendo Achillis. The contraction had also been increased by the patient having worn high-heeled shoes.*

Having thus offered my opinions of the causes of those deformities of the feet which take place after birth, and stated the identity of their symptoms and morbid anatomy with those of the club-foot with which children are born, the probability will, I think, appear obvious that the remote causes are the same: but there are other phenomena connected with the history of these affections which render the accuracy of these opinions almost capable of demonstration. Fœtuses which have suffered some evident derangement in the development of the nervous system, such as those denominated hemicephalous and acephalous, or affected with spina bifida, and those born before the expiration of the natural period of utero-gestation, are particularly obnoxious to this deformity of the feet. (Case IX.) The occurrence of the perfectly analogous deformity of the hands which takes place prior to birth, denominated club-hand, in which the flexors and pronators (analogous to the so-called extensors and adductors of the foot) are likewise contracted, corroborates the opinion that congenital club-foot depends on spasmodic muscular contraction. In the instances which I have examined, of congenital deformity of the hand (club-hand), both in museums and in the living subject, the feet were also affected with Talipes, proving the operation of a common cause. Other circumstances corroborative of this opinion, are the coexistence with congenital club-foot of

* I am convinced of the justice of an observation made to me by Dr. Stromeyer, that rupture of the tendo Achillis is an accident from which, but for the needless interference of our art, the patient would always perfectly recover, without pain during the treatment, or subsequent inconvenience when walking. The application of the slightest bandage, in order to prevent motion of the ankle-joint during the first few days after the accident, is all that is requisite to ensure perfect union: indeed, I think it probable that the application of bandages might be dispensed with.

congenital squinting, and even congenital stammering or mis-enunciation,— diseases which evidently depend either on the increase of the involuntary or the decrease of the voluntary motor powers of the orbital and laryngeal muscles.*

The importance of these facts is increased by the observation I have made, that non-congenital club-foot is likewise occasionally accompanied with strabismus.

It will now be understood why I have admitted the possibility that one of the sources of Talipes in an infant may have proceeded from the circumstance of the mother having, during pregnancy, received a severe fright from some accidental cause. Notwithstanding that we are ignorant of the existence of any direct connexion between the nervous and sanguineous systems of the parent and those of the fœtus, still, as violent mental impressions exercise so powerful an influence upon the circulation of the parent, it is not improbable that sufficient derangement of that of the fœtus may be thereby produced, so as to injure the imperfectly developed and delicate brain and spinal cord of the infant, and thus induce imperfect development of other organs, and spasmodic contractions of various muscles, which lead to different kinds of deformities.

The next department to be considered, the treatment of Talipes, is one to which I am particularly desirous to direct the attention of the profession; and although the arrangement of this treatise will not permit a description here of the whole of the minor points which require attention in the management of the variety of cases of Talipes which come under the care of the surgeon, I shall nevertheless be enabled to state the principles to be followed in every case. The minutiæ of the treatment will be found in the series of cases contained in the Appendix.

Hitherto the deformity has been too often regarded as simply a physical alteration of certain parts of the limb; certain tendons or muscles have merely been considered as too *short*, and the bones of the tarsus deformed, or, in the worst cases, unnaturally jumbled together: consequently a

* Vide Cases IX., XXVII., XXVIII., XXXI.

mechanical plan of treatment best accorded with these ideas of the pathology of Talipes, it being considered that no contracted living tissue, such as a wasted muscle or "*shortened tendon,*" could long resist the operation of a well-applied mechanical power, properly adapted to elongate the contracted parts. Experience has proved this opinion to be erroneous. With an improved knowledge of the morbid anatomy and nature of the disease, the practitioner will adopt, according to the stage at which the case is presented, a plan of treatment more in accordance with the principles of medicine and surgery. He will treat a case of Talipes which has originated since birth from paralysis of the anterior muscles of the leg, in the same manner as he would endeavour to remove paralysis of any other part of the body (see Appendix, Case XXX.): if the case proceed from active, permanent, and involuntary contraction of the muscles of the calf, or the other muscles of the foot, producing Talipes equinus or T. varus, he will, as in the treatment of paralysis, direct his attention to the central organs of the nervous system, the brain and spinal cord, and search for the remote disturbances in the chylopoietic or other viscera, by means of which the incident and reflex functions of the nervous system have thus disturbed the equilibrium of the muscles of the foot. (See Cases XXV., XXVI., XXXI.)

At the same time, to prevent the muscles from becoming affected with structural or organic shortening, through remaining a long period in a contracted state, more particularly during the earliest period of life, when the growth of parts is very rapid, manipulation, friction, and the use of mechanical apparatus, properly contrived and adjusted, must be resorted to. I have by this method of proceeding cured, without operation, cases which had been presented to me for relief by this *dernier ressort* of our art.

Even a congenital case, where the contracted muscles may be elongated by the hands, and the foot thus placed nearly in its natural form, should from analogy be treated in the same manner. I have treated a child who had never walked (of the age of two years and a half when first placed

under my care), born with spasm of some of the muscles of the eyes, of the spine, of the adductors of the thighs and muscles of the calf, producing squinting, partial opisthotonos, rotation inwards of the thighs, and double Talipes equinus. The whole of these affections, with the exception of the strabismus, have been almost entirely removed by the use of ferri sesquioxydum, laxatives of hydr. c. cretâ, with pulv. rhei, and long-continued extensive counter-irritation to the spine, with the addition of frictions and manipulations. (See Case XXVII.)

There are many cases both of congenital and non-congenital Talipes in which the medical part of the plan is unnecessary, either in consequence of the paralytic or spasmodic cause having subsided, or from having existed too great a length of time to render removal probable, and where there remains only an inconsiderable *structural* shortening, although accompanied with great deformity. These cases may be cured in the space of a few months, without relapse, by means of mechanical treatment alone. (See Case XXXII.)

If, however, either in congenital cases, in consequence of the affection of the muscles having occurred at an early period of fœtal existence; or in non-congenital cases, from the deformity having continued unchecked for too great length of time, — structural shortening of the contracted muscles have taken place, which is usually ascertained by the inelastic rigid nature of the contraction of the muscles, the tendons of those muscles which resist the restoration of the foot to its proper form, must, provided that there be no accidental displacement or deformity of the bones, or ankylosis, be divided by the knife, in order to obtain a cure. (See Appendix, Cases I. to XXIV.)

In most cases of Talipes equinus, and in many of T. varus, which require an operation, the tendo Achillis only is required to be divided; in other cases of Talipes equinus I have sometimes found it necessary likewise to divide the tendons of the tibialis posticus and flexor longus pollicis muscles.* In severe long-standing cases of Talipes varus the

* See Cases VII., VIII.

section of the tendons of the anterior tibial, posterior tibial, extensor proprius and flexor longus pollicis muscles is requisite, in addition to division of the tendo Achillis, in order to facilitate the restoration of the foot to its natural shape and position.* The case of congenital Talipes valgus already mentioned will indicate the parts which it may be found necessary to divide in that form of disease. (See page 6 and Case XXVIII.)

I will not detain the reader, either by instituting comparisons between the mode of performing this operation and the subsequent treatment adopted by those who preceded Dr. Stromeyer of Hanover; or by stating my objections to the plans of those who have succeeded him. As I regard Stromeyer to be the regenerator of this important addition to our means of curing club-foot, with other contractions of the ankle, and similar deformities of various parts of the body, and having experienced in my own person the success of his method of treatment, corroborated by the numerous cases which I have cured by the same means, I shall here only briefly enumerate the principles recommended by Stromeyer to be followed.

The tendons of the muscles which maintain the deformity should be divided with as little injury as possible to the skin and neighbouring parts.

No attempt should be made to force the foot into its natural shape immediately after the operation; but the necessary extension for that purpose should be commenced as soon as the external puncture or punctures are completely healed: this occurs about the second or third day.

The lymph which is effused between the ends of the divided tendon or tendons, with the muscles that are not divided, and the ligaments and fasciæ which may impede the replacement of the foot, must be gradually extended until the foot assumes its natural shape, and the ankle can be bent to its fullest extent.

The application of the apparatus by which extension is effected must be continued for a certain period after the cure, notwithstanding that the patient has been enabled to

* Cases XIV., XVIII., XXIII., XXIV.; Remarks appended to Case XVII.

stand firmly, and has improved in walking, in order to obviate the tendency to contraction evinced by the intermediate substance or lymph effused between the ends of the divided tendon.

We may explain the reason of the safety of dividing so large a tendon as that of the tendo Achillis or of puncturing the fascia of the sole of the foot and dividing the tendon of the flexor longus pollicis, by the facts, that no inflammation follows the infliction of so small a wound, that the skin immediately agglutinates, and the severed tendon is placed in the comparatively safe condition of that of a ruptured tendon, between which and an exposed wound of tendon there is the same difference as exists between the simple and compound fracture of a bone, with reference to the probabilities of suppuration or sloughing. I have had under my care seventy-three cases of contractures of the ankle and knee joints, treated by division of various tendons, amongst which there was no instance of the puncture not having immediately united by adhesion. This result is solely attributable to the smallness of the wound, and the non-disturbance of the healing process by precipitate attempts to straighten the limb.*

In the first case which I treated by division of a tendon, and in several succeeding cases, I used for the purpose the same knife as that with which Stromeyer was accustomed to perform the operation, namely, the common curved sharp-pointed bistoury; but finding both the handle and blade of this instrument unwieldy for so delicate an operation, I exchanged it for a smaller curved sharp-pointed bistoury, having a concave edge, the cutting part of the blade seven-tenths of an inch in length, and the greatest width one-tenth of an inch. By using the smallest knife of sufficient strength, the wound inflicted is seldom larger than the

* I have expressed the intention not to institute comparisons between the Stromeyerian method of cure and the mode of operating pursued by the predecessors of Stromeyer; but I may be permitted to remark, that the slow advance of our art with respect to the division of tendons for the cure of contractures mainly arose from the extensive suppurations, sloughings of tendons, and consequent failures, which frequently followed the large incisions made by Sartorius, Michaelis, Delpech, and others.

puncture of a needle; and although in healthy subjects the length of the wound (if not exceeding a few lines) is of little consequence, nevertheless in unhealthy or weakly individuals cicatrisation is ensured by making a small puncture.

The operation of dividing the tendo Achillis is performed as follows: — the patient being seated, an assistant supports the knee, whilst another, drawing downwards the patient's heel with his left hand, and pressing upwards the toes and front of the foot with his right, produces the necessary tension in the tendon proposed to be divided. The operator, after feeling the outline of the tendon with the left fore-finger and thumb, passes the bistoury through the skin, one or two fingers' breadth above the malleolus internus, with one of its sides turned towards the tendon, and the other directed towards the deeper muscles and the tibial vessels and nerves. On being satisfied that the point of the knife has been passed beyond the external edge of the tendon, and has nearly reached the skin of the opposite side, the knife is turned so as to bring the cutting-edge to press against the anterior surface of the tendon, which is then divided by the action of withdrawing the knife from the limb, and commonly by a single stroke. The complete division of the tendon is known by the immediate cessation of the tense resistance, by hearing a distinct snap, and by feeling, before the knife is wholly withdrawn, that nothing remains undivided except the flaccid integuments. The operation does not occupy a quarter of a minute, and is almost bloodless, as usually not more than a single drop of blood is effused.

In order to ascertain whether a scalpel, either straight or convex-edged, was better adapted to the performance of this operation than a concave-edged knife, I have on various occasions employed different knives, passing from the use of that formerly described to the straight French bistoury, and even to a small common scalpel. I find, upon the whole, that a knife with a straight or slightly convex edge is preferable to one too much curved or too concave: provided, however, the operator possess ordinary dexterity, the form of the knife which he uses will be of but little consequence.

The division of the tendon of the posterior tibial muscle is, in my opinion, best accomplished at the distance of two or three fingers' breadth above and behind the internal malleolus. The point of a strong and straight bistoury should be introduced through the skin at the outer edge of the tendon, and passed between it and the tendon of the long flexor of the great toe, directed towards the tibia. As soon as the knife reaches the bone, the handle should be depressed outwardly, and the point carried internally beneath the posterior tibial tendon, and continued onwards until the surgeon is satisfied that the point has passed beyond the inner edge of the tendon. He may then feel that he has the tendon upon the edge of the knife, when by a few slight cutting motions he may divide it without difficulty. No snapping sound, similar to that which follows the division of the tendo Achillis, is heard when the section of the posterior tibial tendon is accomplished; as the fleshy fibres of this muscle take their origin so low towards the malleolus internus, that they prevent the occurrence of any considerable retraction of the superior end of the tendon.

The most favourable situations for dividing the tendons of the tibialis anticus and flexor longus pollicis muscles, are where the former passes in front of the ankle-joint, and where the latter is felt most prominently in the sole of the foot, in those cases where division is required. The manner of dividing each of these tendons is to pass the point of a bistoury through the integuments, and then with great care beneath the tendon, avoiding to carry the knife farther than is absolutely necessary, and dividing the tendon from within outwards, in order not to endanger any of the neighbouring structures. The recoil of these muscles, on their tendons being divided, is distinctly felt and heard. If they be thus cautiously divided, no risk is incurred of injuring the anterior tibial, posterior tibial, and internal plantar arteries, or any of the nerves. The wounds made in the integuments are extremely small, and unite by adhesion; consequently all chance of suppuration and sloughing is avoided.

After either of these operations, the application of a few strips of adhesive plaster and a common bandage is the only dressing required. The limb should be laid in its deformed position on its outer side, and supported by a common wooden or pasteboard splint. The latter, after being softened by soaking in water for a sufficient length of time, may be advantageously applied to the limb a day or two before the operation, to enable it to mould itself to the exact form of the limb, and thus afford a better support after the operation, and hold the limb more exactly in its deformed position. The apparatus to which I resort for the

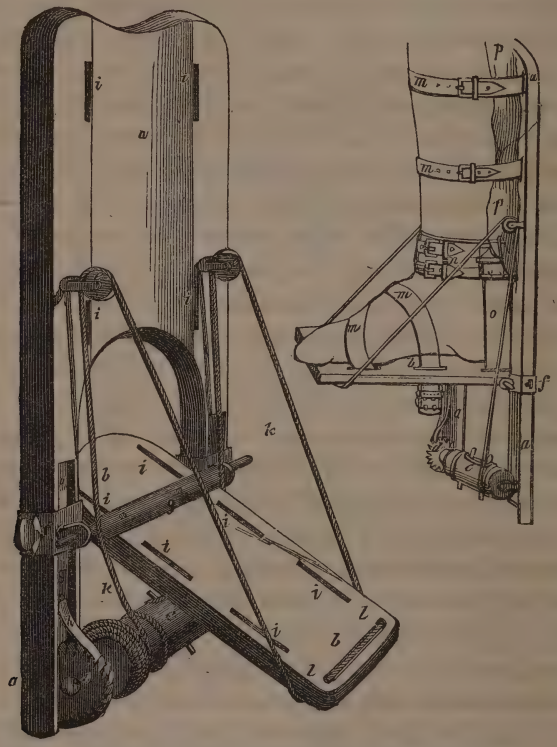


FIG. XIII.—View of Stromeyer's foot-board for the treatment of Talipes equinus and varus after the division of the tendo Achillis. It can be applied to the right or left leg, according to the circumstances of the case. The smaller of these figures represents a foot which had been affected with Talipes equinus, (such as is seen in fig. 2, page 3,) nearly

necessary extension of the limb, is the foot-board invented by Stromeyer (fig. 13), and another apparatus (fig. 14), constructed in some respects upon the principle of that described and represented by Scarpa in his work upon the cure of these deformities. The original instrument of Scarpa, although highly valuable in affording one of the principles upon which a correctly adjusted and efficacious instrument for the cure of these contractures must be made, was entirely defective in providing means for drawing the heel downwards. This Scarpa anticipated would gradually take place when the patient walked, the tendency of the toe to turn inwards being at the same time obviated, and the foot maintained securely in a favourable position by his apparatus. Stromeyer added several improvements to Scarpa's instrument, from which, in addition to my experience and numerous private suggestions received from him, I have profited, by a different adaptation of the screw to act upon the ankle-joint, and by altering the arrangement of the straps. The mode of applying Stromeyer's foot-board and the latter apparatus will be understood by an examination of the figures. The former is most useful in the treatment of Talipes equinus, although it may be resorted to in those cases of T. varus which have not attained the more advanced stages of the deformity. Its especial utility in T. varus arises from the very ingenious contrivance of the foot-part, which may be rendered more or less oblique, and thus accommodated to the obliquity of the sole of the deformed foot.

restored to its natural degree of bending at the ankle. The angle formed by the foot-piece (*b b*) of the apparatus with the leg-piece (*a a a*) can be increased or diminished by turning the windlass (*c*) forwards or backwards, and by that means loosening or tightening the cord (*k k*), which, after passing through the holes (*l l*) of the foot-piece (*b b*), and over the pulleys (*e e*), is fastened to the windlass. The foot-piece of the apparatus can be rendered oblique by turning the thumb-screw and loosening the slide (*f*) through which the axle (*g*) passes. The spring (*h*), which is received between the teeth of the cog-wheel (*d*), prevents the windlass from turning backwards, except when the surgeon purposely raises it. The double row of fissures (*i i i i i*) are for the passage of the straps (*m m o m m*) by which the foot is secured in the desired position; *p p* marks a cushion placed between the leg and the apparatus.

The second apparatus serves for the treatment of a greater variety of cases, either of T. equinus or T. varus, whether or no the operation of dividing any tendon be deemed

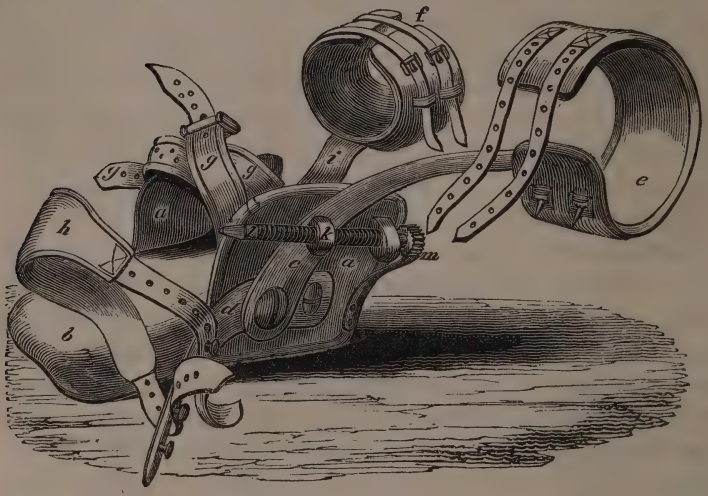


FIG. XIV. represents the second apparatus mentioned in the text, made for a left foot. The utility of this apparatus in the cure of T. varus exceeds that of any other instrument which I have resorted to or found in use by others. Its superiority depends upon the application of an elastic power for the purpose of overcoming the resistance of the adductor muscles, the internal ligaments of the ankle, and the contracted tissues on the inside of the foot, instead of relying solely upon the inelastic pressure of screws and straps. The elastic property of steel springs, by the constancy of their action, approaches somewhat to the nature of the contractility of animal tissues, and is capable of effecting the elongation of contracted muscles or ligaments with more readiness and less tightness of the apparatus than a greater amount of the pressure of screws, straps, and bandages, which, in opposition to the elastic pressure or traction of the spring, may be called *dead* pressure. This apparatus is calculated to overcome the threefold alteration of the position of the foot which characterises Talipes varus (see p. 4); and by substituting an upright firm bar of steel for the spring *c*, is well adapted to cure Talipes equinus, whether or no any operation be necessary.

The letters *a a* and *b* designate a shoe formed of iron, covered with leather, and well padded with horse-hair; *c* is a steel spring, which, by means of the padded strap *e*, is worn upon the outside of the leg; *i* and *f* shew a strap and bandage to go round the ankle, by which the heel is held securely in the shoe. The straps *g g* hold the heel

requisite. It has, moreover, the advantage of enabling the patient to walk with less difficulty during the process of cure.

After the healing of the wound, great caution is necessary, on the part of the surgeon, in the manner of conducting the extension of the medium which connects the ends of the divided tendon, and of gradually overcoming the resistance often presented by the ligaments, fasciæ, and the undivided muscles, to the restoration of the foot to its natural shape. The skin should be protected from friction and uneven pressure by the application of an elastic cotton-web bandage, and by filling up with wadding those inequalities of the surface of the tarsus which arise, in many instances, from unequal projection of the bones.

In many cases the slightest pressure exercised by the instrument will suffice to overcome the deformity without producing pain, provided attention be daily paid, and the

firmly towards the inside of the shoe, whilst the short spring *d* draws the toes and front of the foot outwards, by means of the padded strap *h* passed round it. The screw *l*, which moves through a female screw *k*, (itself fixed as a rotatory rivet to the spring *c*,) acts upon the ankle-joint, and enables the surgeon to bend it as rapidly or as gradually as he may please. In cases where the tendo Achillis has been divided, the use of a screw for bending the ankle-joint is less objectionable than any similar inelastic power would be were the tendon intact. The greater part of the resistance to *bending* the foot is removed by that operation; but as the active causes of the *adduction* and the *rotation inwards* of the foot, analogous to supination of the hand, remain, the springs, by being braced up against the foot and leg more or less tightly, according to the exigencies of the case, tend constantly to regain the form which they have when unshackled by the straps, and thus gradually overcome the contracted muscles and ligaments, and draw the deformed foot in two directions opposed to the deformity — those of abduction and rotation outwards. If the surgeon, acquainted with the anatomy and pathology of Talipes varus, will put his sound foot into one of these instruments, and endeavour whilst his foot is there to give it the form of T. varus, he will feel how strongly the springs oppose his attempts; in fact, he will be convinced that if he wore the instrument sufficiently long, his sound foot would be converted into a deformity resembling the opposite of T. varus, namely, Talipes valgus. It is at the point intermediate between these two diseases that the practitioner must stop in the treatment of the former—at the position of the foot intermediate between adduction and abduction—at the point corresponding to the natural position.

straps and screws be tightened whenever they become loosened by the progress which the foot makes in the required direction. In other subjects, where the resistance is greater, more pressure is required, accompanied by a greater degree of pain; but the surgeon must constantly bear in mind, that after the performance of an operation, or in treating a case without operation, he must not always expect to restore the foot rapidly to its natural position; he must guard against violence, and endeavour, by the most assiduous and patient attention to the case, to overcome the difficulties presented. Notwithstanding that great care may be used, he may occasionally have to contend with excoriations, which occasion a loss of time, by the necessity they induce of loosening the apparatus, and by their slowness in healing: a still greater injury may also sometimes arise from the application of too great a pressure. I have been consulted in two cases where extensive erysipelatous inflammation had resulted from the limb having, on the first application of the apparatus, been too tightly compressed by straps, and from the exercise of too great an extending pressure. I have also witnessed the occurrence of sloughing from this cause. These complications, induced by inattention to this particular subject, may threaten the total failure of the operation. Occasionally the pain in the sole of the foot, produced by the pressure requisite to bend the ankle-joint, is intolerable: I can well appreciate the amount of suffering thus occasioned, having experienced it to a great degree in my own case. After witnessing in many patients the distressing pain felt in the sole of the foot when the form of the bones, or corns, caused particular parts of the sole to be disproportionately compressed, about two years since, at the suggestion of Mr. Robert Davey, of Great Ormond Street, I placed an air-cushion between the sole of the foot and the foot-piece of the apparatus, in order to produce an equal distribution of the pressure over the whole of the sole. The pain was instantaneously relieved; and I am indebted to the use of the air-cushion for the comparatively little pain with which the cure of numerous cases has been attended.

I have caused the construction of various modifications of the apparatus hitherto recommended, suited to the exigencies of peculiar cases, the management of which was particularly difficult: but it is unnecessary to describe them here; for as those represented figs. 13 and 14 are adapted for the cure of the large majority of cases of club-foot, my object of familiarising the practitioner with the treatment of these and similar distortions will be fully attained. Additional information on this subject will be found distributed among the various cases related in the Appendix.

In children, the cure of Talipes is occasionally interrupted by the occurrence of any of the numerous indispositions to which, at their period of life, they are exposed. In this case, we must, according to the severity of the illness, be content to proceed more slowly with the extension, and even to suspend it; we should, however, endeavour not to lose ground, but, on the contrary, to retain, during the temporary interruption, the benefit previously acquired.

The apparatus I have used for the treatment of Talipes valgus is similar to the second instrument described for the cure of T. varus (fig. 14), with this difference only, namely, that the springs, which, in the latter case, are placed upon the outer side of the limb, are required in T. valgus to be worn upon the inner side.

The extent of external deformity of the foot does not determine the length of time necessary to effect a cure; other circumstances exercise a much greater influence in this respect. One of the most important is the degree of alteration from the natural shape and position which the individual bones of the tarsus have undergone, produced either by the occurrence of the disease at an early period of the development of the embryo, when the bones were yet soft, by the wearing improper instruments, or walking with the foot in its deformed shape, and thus injuring the bones by attrition against the earth. The shortened condition of some of the ligaments of the ankle in T. varus and equinus, particularly the ligamentum deltoideum, and the ligaments of the under surface of the tarsal arch, are serious difficulties to

be overcome in long-standing cases. Those muscles of the sole of the foot which it is inexpedient to divide, and which, in some cases of T. varus and equinus, draw the anterior extremities of the metatarsal bones backwards (towards the posterior tuberosity of the os calcis), for a lengthened period resist our endeavours to stretch them.

There are some cases of T. varus and equinus where, after division of the tendo Achillis, and healing of the puncture, the foot might be at once restored to its natural position; but to avoid any interference with the reunion of the tendon, I prefer the gradual replacement of the foot.

In the average of cases of club-foot, whether congenital or otherwise, two or three weeks elapse after the operation before sufficient bending of the joint is obtained; previously to which, however, the patient is allowed to walk, wearing the apparatus: after the expiration of another fortnight, the greater part of the tenderness of the ankle-joint, produced by the stretching of the ligaments, subsides. By this time the union of the tendon has acquired sufficient firmness to allow of walking and exercise in the open air. In the greater number of cases, particularly in children, the ankle-joint requires to be supported by a modification of the instrument used to effect the extension, or by one or two thin steel springs, or pieces of whalebone, sewn between the outer leather and the lining of the side of a lace-up boot. Some time elapses before the gait of the individual acquires the ultimate perfection of which it is susceptible. Children advance more slowly in this respect than adults, as they limp if they feel the least uneasiness, and cannot take so much pains with their manner of walking. I have had many adult patients who, within two months after the performance of the operation, have walked several miles, and have had but little appearance of lameness. I have, however, treated one very bad case of adult congenital T. varus, which was under my care for nine months,—that of a gentleman who had walked from infancy without the slightest mechanical support, and whose foot had consequently reached a frightful

stage of deformity (see Case XXIII.); but the ultimate success, notwithstanding the attendant difficulties, enables me to refer to this case as a triumphant proof of the advantage of the Stromeyerian method of cure.

The necessity of treating these affections according to this recently improved method, has, I trust, been sufficiently demonstrated in the foregoing observations. The consideration of the extent of these deformities, of their numbers and varieties, combined with the fact elicited in the prosecution of this subject, that deformities of other parts of the body are curable by the division of tendons, render it one of the most interesting and valuable additions to medical knowledge that even the present advanced state of our science has produced. These successive improvements offer a most striking indication of the progress of our art, and afford the most satisfactory guarantee for its continued advancement.

APPENDIX.

CASE I.

TALIPES EQUINUS ACQUISITUS OF THE RIGHT SIDE.

Non-congenital contracture of the foot, arising from paralysis of the anterior tibial muscle, and consequent contraction of the gastrocnemii and other true flexors, from long-continued want of antagonists.—Cured by division of the tendo Achillis.*

P. W., ætat. 14, of tall stature, healthy complexion, and robust habit. The mother states that she was born perfectly sound, but that at the age of two years, when she ought to have walked well, it was noticed that she did not use the right foot like other children, "but dragged it upon the inside." In proportion as she advanced in years and growth, her lameness increased; the heel having been drawn up, so that for seven or eight years she has been unable to place it on the ground. Her mother has no recollection that she had convulsions or fits of any kind during the first two years of her life, or that dentition was particularly troublesome; she has always been of a constipated habit. She has had instruments of various kinds applied by different mechanists, in order to overcome the contraction of the muscles of the calf, but without effect. At the present time her lameness consists of an inability when walking to place more than the point of the foot upon the ground (see fig. 1, which, as regards external form, exactly resembles

* These muscles, situated on the posterior part of the leg, are analogous to the flexors of the arm, as regards position, diseases, and even function. Some of them flex the toes. They are called by anatomists and surgeons extensors of the ankle-joint, because they straighten the foot; but by Rudolphi, V. Walther, Palletta, and other physiologists, they are denominated flexors. Pathologically, we see that they correspond with the flexors of the arm; as in *club-hand* it is the flexors and pronators which are affected, and not the extensors and supinators. That they are flexors, is particularly evident in the quadrumana, for instance, where the hind feet are used for grasping as readily as the fore.

this case), the heel being drawn up between two and three inches; the weight of the body is consequently borne by the anterior extremities of the metatarsal bones. The integuments of this part are covered by a painful corn, particularly over the ball of the little toe; this shews that in walking the toe is disposed to twist a little inwards, so as to constitute an imperfect T. varus. Another source of pain arises from the strain exercised upon the tarsal arch through treading solely upon the toes: thus on walking a short distance, so much pain is experienced across the instep, accompanied with a sensation of weakness, that her lameness then becomes greatly increased. There is very little absolute deformity in the foot: the tarsal bones are rather prominent upon its outer side, and there is (see fig. 15) a

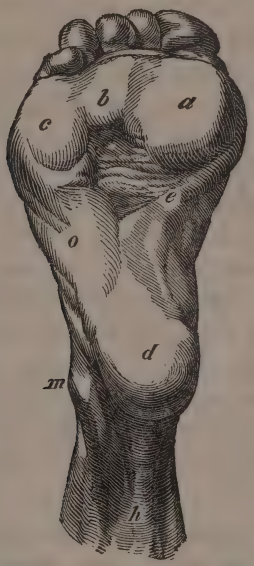


FIG. XV.—The sole of a foot affected with non-congenital T. equinus, drawn from the subject of Case I. The letters *a b c* indicate the situations covered with painful corns; *o* marks the position of the os cuboides, and *d* the under-surface of the os calcis. The integuments investing these two bones have never touched the earth. The letter *e* indicates a ridge occasioned by the tense tendon of the flexor longus pollicis muscle and the internal edge of the thick plantar fascia; *m* marks the external malleolus; *h* the tense tendo Achillis.

striking lateral expansion of the fore part of the foot, upon which she has always trodden; the width of the under-surface of the heel being only $2\frac{3}{8}$ inches, whilst that of the under-surface of the front of the foot, measured across the metatarso-digital articulation, is $4\frac{3}{8}$ inches.

The leg is from half to three-quarters of an inch shorter than the other; its muscles, although much smaller than natural, are less wasted than is often the case in Talipes. Whilst pressing the front of the foot firmly upwards, there is a yielding of the muscles upon the back of the leg; but the heel is again forcibly drawn up on desisting from the endeavour to bend the foot. The heel is involuntarily drawn up higher in walking than when the limb is at rest, in consequence of the action of the gastrocnemii being uncontrolled by any antagonist muscle.* She possesses no voluntary power over the tibialis anticus, but, by means of the peronei, can draw the point of the foot outwards, and, when in the sitting posture, can also act upon the gastrocnemii.

Aug. 16, 1837. Divided the tendo Achillis in the manner described p. 30, using, however, to-day a small straight French bistoury, instead of a concave-edged knife. The retraction of the divided tendon was in this instance considerable, and accompanied by a loud snapping sound, usual whenever the gastrocnemii are not, prior to the operation, contracted to nearly their utmost extent. The limb was dressed with adhesive plaster, and laid upon its outer side, supported by a pasteboard splint. The patient did not complain of pain, and was, equally with her mother, surprised that what had been done was the only operation she had to undergo.

18th. Puncture completely healed, and without the occurrence of the slightest pain. She states, in answer to my inquiries, that she has frequent "catchings and tremblings" in the muscles of the calf and the other muscles of the leg. Ordered the continuance of her ordinary meat and vegetable

* The cause of this symptom is more fully detailed in my dissertation, "Symbolæ ad Talipedem Varum cognoscendum."

diet, with half a pint of porter daily. Laxative draught occasionally if required.

On the 19th, Stromeyer's foot-board (fig. 13) was applied, and very slight extension exercised; I expected that very little mechanical power would be necessary to bend the ankle-joint to its fullest extent, the form of the astragalus and tibio-tarsal articulation being unaltered, the ligaments but slightly contracted, and the resistance of the tendo Achillis removed by the operation. On the 22nd (the sixth day) the report entered in my note-book was, "she has not hitherto felt either inconvenience or pain from wearing the foot-board, or from the stretching of the divided part." The elevation of the toes was gradually carried on, until, at the expiration of a fortnight, the foot formed the natural angle with the leg, so that on standing erect the entire sole and heel touched the ground; the patient having since the fourth day after the operation assisted in obtaining this desirable end by walking in the apartment wearing the foot-board.

The patient remained in my neighbourhood until the expiration of the fourth week, when she returned to her abode in a distant part of the metropolis; being able to walk quite easily with a lady's common lace-up boot, stiffened on the inside with a piece of whalebone. All that remained of her lameness was a slight limp, chiefly occasioned by the affected leg being three-quarters of an inch shorter than the other. The pain across the instep, which she felt previous to the operation, has entirely ceased. As the period elapsed since the operation was short, she was directed to wear *at night* an instrument* adapted for maintaining the foot in its natural position during sleep.

Nov. 15, 1837. "Walks at present extremely well, and from her gait a casual observer could not form an idea that she had ever laboured under a lameness from contracted gastrocnemii. She walks still with a trifling limp, occa-

* The instrument represented fig. 14, constructed with a firm perpendicular stem, instead of the spring (*c*), to be applied to the outside of the leg, as there shewn.

sioned by the difference in the length of the extremities, and from tenderness of the ball of the great toe. It may likewise be observed that she does not raise the front of the foot freely, but that, to avoid touching any unevenness of the ground with her toes, she requires to elevate the knee somewhat more than is usual. On examining the foot, I find that she can voluntarily contract the gastrocnemii and other muscles upon the back of the leg, and raise the heel, but that she has no power over the tibialis anticus, *this muscle being even now completely paralysed;* she can extend the toes, and by means of the peronei raise the outer side of the foot, and abduct it. She cannot, therefore, bend the ankle by the exercise of the muscles proper to that action (although the joint is freely moveable in all directions by the hand); but in the endeavour to bend the foot, abduction chiefly results. The inner ankle projects considerably, in consequence of the peronei not being antagonised by the anterior tibial muscle. The deficiency of the tibialis anticus causes, however, little impediment in walking, as the lacing of the boot supplies its place."

This young woman informed me, Feb. 1, 1838, that she could walk with facility six or seven miles, and without any pain or particular fatigue. The former painful corns, corresponding to the anterior extremities of the metatarsal bones, had quite disappeared, through the pressure of the weight of the body being at present borne equally by the entire sole and heel.

The following is a subsequent report, Oct. 9, 1838: "The mother of the young woman mentions having observed within the last few months a great alteration in the form of the leg and foot. Previously to the operation, the leg was destitute of symmetry, being of an equal thickness throughout its length; but at present the outline of the muscles of the calf is visible. The sole is of a perfectly natural form; the heel is now larger; and the great toe, with its metatarsal bone, having been pressed forward by the flattening of the tarsal arch, the length of the foot is increased an inch and a half along its inner margin. The front

of the foot, therefore, instead of appearing truncated—all the toes of nearly equal length—see fig. 15, has at present the pointed form peculiar to its natural shape. The paralysis of the anterior tibial muscle continues; she still, however, improves in her gait. I have enjoined the necessity of bending the foot to its fullest extent at stated periods, and even the endeavour to force it beyond the present angle of flexion.

Remarks.—The disproportionate development of the fore part of the foot and heel, connected with the fact that all the toes appear of equal length, is worthy of notice, as it invariably accompanies, in a greater or less extent, certain cases of Talipes. It does not solely arise from pressure upon that part of the foot, but is more particularly caused from the flexor longus digitorum and flexor longus pollicis muscles, and the whole of the muscles of the sole of the foot, drawing the three larger toes and the anterior extremities of their metatarsal bones back toward the part from whence they derive their origin; producing in this manner the unnatural concavity of the sole and convexity of the instep which characterise T. equinus and varus. In such cases, after the cure has been accomplished by division of the tendo Achillis, and the patients have walked for some time, this great breadth of the front of the foot diminishes considerably; and the toes, instead of appearing all of equal length—or, rather, instead of the small toes reaching as far forwards as the great toe,—they all assume the natural relation towards one another, the great toe becoming the most prominent.

It is worthy of remark, that when the ligaments of the ankle-joint are much contracted, or the articular surfaces deformed, the assistant holding the foot, owing to these additional obstacles to bending the joint, is prevented from keeping the tendon extra-tense for the operator, and consequently on its division no sudden retraction is felt or heard.

The "catchings" mentioned page 42, which almost always exist, but seldom become the subject of complaint, are purely local, and depend upon the fibres of the muscle,

the belly of which has been relaxed by the section of the tendon, drawing themselves more and more closely together; and upon the disturbance of the state of some of the muscles through the loss of their antagonist gastrocnemii.

When the proper form has been rapidly given to a foot, the precaution of retaining it in a mechanical apparatus for some time, particularly at night, should be adopted, to obviate the chance of any recurrence of the deformity from contraction taking place in the organised lymph connecting the two extremities of the severed tendon. The possibility of this contraction must be borne in mind until that new lymph has become thoroughly organised—converted into a dense ligamentous or fibro-cartilaginous band, and admitted into the rank of an integrant part of the body, capable of performing the function of original tendon. No necessity exists for the patient wearing any mechanical contrivance during the day, the action of walking being alone sufficient to retain the ankle-joint in its newly-acquired position. Under such circumstances, another advantage of wearing some apparatus at night for a certain time, is, that all the tissues on the front of the leg and ankle—fasciæ, ligaments, and muscles—having been weakened by the constantly elongated state so long maintained by the contraction of the muscles upon the back of the leg, are thus afforded the opportunity gradually to recover, and ultimately to adapt themselves to the required shorter state.

In the heading of this case I have assigned the remote cause of the lameness to paralysis of the tibialis anticus muscle: the long extensors of the toes and the peronei may also have been partially affected. The accuracy of this diagnosis was confirmed by the condition of the muscles of the leg, described in the note taken thirteen weeks after the operation (p. 44).

The tenderness of the ball of the great toe there alluded to arose from the anterior extremity of the first metatarsal bone being drawn rather forcibly to the ground in a more perpendicular direction than natural, by the contraction

of the flexor longus pollicis muscle. The patient being young, I ordered her to walk much, in order to diminish the arch of the foot, by which means I expected that the tenderness would be removed: this anticipation was shewn to be correct by the improved state described in the latest report. In other patients, I have occasionally found it necessary to divide the tendon of the flexor longus pollicis muscle for the relief of this symptom, even after the ankle-joint had been restored to its proper function by division of the tendo Achillis.

CASE II.

TALIPES EQUINUS CONGENITUS.—(Fig. 1.)

Congenital contracture, or club-foot, of the right side, occasioned by spasmodic contraction and structural shortening of the muscles of the calf; the latter being a consequence of the disease having continued unchecked for fourteen years.—Cured by division of the tendo Achillis.

The particulars of this case have already appeared in a weekly periodical,* in the form of a letter from the father of the patient, a member of the profession. It much resembles Case I. in respect to the external appearance of the foot; but it differs in being congenital, and not produced by paralysis, and will therefore serve to illustrate the points of resemblance in the symptoms and treatment of the two diseases. I prefer relating the case in the words of the parent to copying the report from my note-book; but I shall append a few observations.

"The time is fast approaching when cases similar to the one which I am about to narrate will have been so common as to render it a work of supererogation to record them; but in the infancy of this most scientific, safe, and useful operation, it becomes the duty of every man who has it in his power to help to remove the prejudices which exist relative

* The Lancet, vol. ii., 1836-7, p. 589.

to the danger to be apprehended from the division of tendons, and the scepticism as to its beneficial results.

"My eldest son, a healthy boy, born in Feb. 1823, was the subject of congenital club-foot. The case was not considered to be a very bad one, and I was assured that by dint of rubbing, pulling, and the use of appropriate mechanical contrivances, the deformity might be remedied. Accordingly I placed him under the care of the late Mr. Shaw, and that gentleman's plan of treatment was sedulously followed for several years; subsequently he was seen by other medical men; but all that skill could suggest or contrive was tried in vain, for at the end of fourteen years and two months the boy appeared to be doomed to irremediable lameness. I had heard that Dr. Stromeyer of Hanover had divided the tendo Achillis; but, notwithstanding the most diligent inquiry, I could not learn that the operation had ever been attempted by an English surgeon. Great, then, was my delight on reading in the Lancet of April 1st, 1837, an account of the discussion of Mr. Whipple's case before the Royal Medical and Chirurgical Society. I wrote immediately to Dr. Little, * * * * who offered to undertake the cure of my son's foot if I would send him to London. * * * *†

"The following account, drawn up prior to the operation, will shew the state of the foot:—'In the erect posture, the patient appears to be simply standing upon the toes and ball of the foot of the affected limb, the heel being drawn up by the muscles of the calf as high as possible, not touching the ground by three inches (see fig. 1, which was drawn from this patient's foot.) In consequence of the extreme rigidity of the tendo Achillis and gastrocnemii muscles, it is impossible to place the foot in its natural position by bringing down the heel. In walking, the patient limps a good deal, and treads on a very small part of the sole; there is not much inclination of the foot inwards, though he treads more upon the ball of the little toe than of the great toe. In the act of walking there is no bending at the ankle-

† The asterisks mark the omission of a few laudatory sentences not essential to the history of the case.

joint. Although the entire affected extremity is rendered longer through the extension of the foot, the leg is in reality somewhat shorter than that of the opposite side. The tibia and fibula are also more slender; the inner malleolus presents itself more anteriorly, and the other more posteriorly than natural. The heel being drawn up as much as possible causes the foot to appear as a continuation of the leg; it is, in fact, nearly in a straight line. The arch of the foot is much greater than natural; the tarsal bones, therefore, present a great projection upwards; the affected foot is an inch and a half shorter than its fellow; the muscles of the leg are much less developed than those of the sound limb. There is no paralysis of the tibialis anticus, peronei, or other muscles on the front of the leg. He can put them in action at pleasure, without, however, being able to move the foot much.'

"On the 1st of May (in the presence of my friend Mr. Kingdon, Mr. Hamilton of the London Hospital, and myself), Dr. Little divided the tendo Achillis, about an inch and a half above the malleolus, by introducing a very narrow slightly curved bistoury between the tendon and the deeper seated muscles and tibial vessels, directing the edge of the knife against the front of the tendon, dividing it from within outwards, leaving the skin covering the tendon untouched. The section was accomplished most skilfully; and the puncture in the skin was covered with a strip of adhesive plaster, and a loose bandage was applied round the foot and leg. Any separation of the divided ends of the tendon was prevented by placing the foot, in its deformed position, upon a stiff pasteboard splint, applied along the outer side, and by adjusting the limb, with the knee bent, upon a pillow. On the second day the report was, that he had had no pain or tenderness, and would not have known that any thing had been done to the limb, but for occasional contractions of the muscles of the calf, they having lost their fixed point.

"3d day. The puncture (which is inconceivably small) was found agglutinated, although not firmly cicatrised; the application of the extension foot-board was consequently

deferred another day or two. The ends of the divided tendon cannot be felt, owing to the effusion of coagulable lymph, which is necessary for its perfect reunion.

"4th day. The puncture firmly cicatrised, and Stromeyer's foot-board applied. The boy is perfectly well, and takes his ordinary diet. The handling of the foot preparatory to the application of the apparatus, and the attempt to draw the heel down, produce no pain.

"10th day. The stretching of the lymph effused between the ends of the tendo Achillis, the elongation of the contracted ligaments of the ankle-joint, and the consequent bending of the foot upon the leg, have been gradually continued, so that the foot at present is nearly at a right angle with the leg; and all this has been effected without pain. He has been able, for the last two or three days, to walk about the room with the foot-board, which diminishes the irksomeness of wearing it, and assists much in bringing down the heel to the ground.

"14th day. The foot is completely at a right angle with the leg.

"19th day. To-day the use of Stromeyer's foot-board is partly discontinued, and he wears in its stead Dr. Little's modified Scarpa shoe (fig. 14), which tends better to overcome the too great curvature of the bones of the tarsus, now that the foot is bent to the right angle. He walks about in it very well; the entire sole and the heel touch the ground; nor does the foot when removed from all apparatus return to its vicious position. The arched form of the dorsum of the foot, and the inclination of the front row of the tarsal and metatarsal bones inwards, is now more striking to the casual observer than before; but Dr. Little informs me that the former will be gradually overcome by walking upon the entire sole; the latter, to a considerable extent, by persevering in the use of the instrument.

"At the end of six weeks and a few days my son returned home, and has since been steadily improving. He continues to wear the same apparatus by night, and during the day a common laced boot, with an iron stem on the

outside of the leg. His lameness is very slight, and becomes less daily; but it must be expected that until there is greater flexibility of the ankle-joint, less tenderness of the sole (which, be it remembered, never before touched the ground), and the different muscles, ligaments, and bones have had time to accommodate themselves to the entirely altered state of things in the limb, he must go halting.

"GEO. RAY, M.R.C.S.

"*Milton, next Sittingbourne, Kent, July 6th*, 1837."

The report, August 12th, was, that "a mere looker-on would not detect any difference between the operated and the sound foot; and he can walk several miles without difficulty. A gradual enlargement of the gastrocnemii muscles has taken place, as at present the leg measures at the largest part of the calf two inches more in circumference than in the preceding June."

Greater firmness of gait, and increased mobility of the ankle-joint, having been obtained by daily exercise, and all tenderness of the ligaments of the ankle-joint, which had been stretched to allow of the bending of the foot, having subsided, and the lymph uniting the divided ends of the tendo Achillis having become consolidated,—no further apprehension could exist of the youth injuring the limb through anxiety to walk quickly, regardless of impediments or unevenness of the surface of the ground. The use of an iron on the outside of the boot was consequently laid aside; he was allowed to walk with a common lace-up boot, stiffened on the inside by a thin steel spring, which, in addition to a trifling support afforded the joint, tended to direct the point of the foot outwards. It had also the advantage of assisting his endeavours to walk on the inner edge of the foot, rather than on the outer edge.

In the month of October 1837, his entire gait and the manner of placing the foot upon the ground were so natural, that I directed him to dispense with all mechanical support.

The following extract from a letter received from Mr. Ray a year after the last report, will shew the subsequent

progress of this case: "My son returned to school after the Christmas vacation. I saw him about three weeks since; he was in fine health and spirits, and can hardly be said to be lame. Those persons who knew him before the operation was performed are surprised and delighted with the change; and those who have become acquainted with him since, are obliged to look closely before they can discover any difference between the limbs. The foot is flat on the sole; he wears a common Wellington boot, and can walk eight or ten miles without fatigue."

Remarks.—The consideration of this case suggests several points of comparison with that which precedes it. The patients were nearly of the same age, and the disease had reached the same grade of deformity; but the former was non-congenital, arising from paralysis of the anterior tibial muscle, and consequent contraction of the muscles upon the back of the leg; whereas the latter had arisen anterior to birth, and was produced by spasmodic contraction of the muscles of the calf. The mechanical means applied prior to my having been consulted had failed in either case to effect a cure. In both instances the rigidity of the contraction of the muscles of the calf determined me not to depend solely upon the application of mechanical means, but to have recourse to the division of the tendo Achillis.

Owing to the length of time the disease had existed, the contracted muscles in both cases had undergone structural shortening, in addition to the contraction of the muscular fibres; the result, in the first case, of the exercise of the organic contractility of muscular fibre unchecked by antagonist muscles; and in the second, with respect to the gastrocnemii, the consequence of spasmodic contraction. In both cases the posterior tibial and long flexor muscles of the toes participated with the gastrocnemii in the maintenance of the deformity. In Case I. they were contracted from the same cause as that by which the gastrocnemii were affected, the want of antagonists. I believe that in Case II. the gastrocnemii only had in the first instance been spas-

modically contracted; whilst the contraction of the posterior tibial and long flexor muscles of the whole of the toes was not of a spasmodic nature, but merely consequent upon the foot having remained since birth in the extended position. The *proximate* cause of the contraction of the fibres of these muscles (tibialis posticus, flexor longus pollicis, flexor longus digitorum,) was in both cases the exercise of their organic contractility, through not being stretched out and excited to alternate contraction and relaxation by their antagonists; in Case II., not because those antagonists (anterior tibial and extensors of the toes) were affected with paralysis, but because they were overpowered and rendered incapable of acting by the spastic rigidity of the gastrocnemii.

My opinion of the exemption from spasmodic contraction of the posterior tibial and flexor muscles of the toes in Case II., arises from the circumstance of the deformity having been that described as Talipes equinus; whereas, had the posterior tibial muscle been primarily and spasmodically affected, adduction of the foot would have resulted, through the os naviculare and front row of the tarsus, as well as the metatarsus being drawn inwards by that muscle, which constitutes Talipes varus (see the definition of T. varus, pp. 3, 4).

These minute investigations concerning the individual muscles involved in the production and maintenance of the deformity, as well as the inquiry into the particular nature of the contraction with which in each case the muscles are affected, may appear unnecessary to that surgeon who would be disposed to consider solely in a mechanical point of view a limb thus deformed, and to decide, from an examination thus conducted, the number of muscles which may be contracted, and proceed at once with the division of their tendons. These distortions must, however, be considered in their physiological and pathological relations, to prevent the division of a greater number of tendons than is absolutely required for the restoration of the limb. The surgeon must therefore determine which of the muscles are contracted in consequence of paralysis of their antagonists, and which are spasmodically contracted. He will be assisted in this

inquiry by the institution of a careful comparison of the position and shape of the deformed foot with the natural positions of the sound foot presented by the action of individual muscles, and by a diligent examination into the origin of the deformity; he will likewise determine which of the muscles are contracted merely from long-continued inactivity of the distorted joint, and which are affected with structural shortening. He will find that the muscles affected with structural shortening preceded by spasmodic contraction, as in Case II., most frequently require division, as they pertinaciously resist elongation by mechanical means. The next form of contraction the permanent subjugation of which by mechanical means is exceedingly difficult, is spasmodic contraction unaccompanied by structural shortening, where, although the limb can be restored to its proper form by pressure with the hand, the belly of the affected muscle is drawn up into a firm ball immediately the hand of the surgeon is removed, as in the case of a muscle affected with cramp. The cure of this form of contraction by mechanical means alone is very fallacious; the deformity often returns, unless the application of instruments be perseveringly continued.

To these succeed the variety occasioned by the muscle unaffected with spasm having become contracted from paralysis of its antagonists, as in Case I., or whose contraction has arisen from long-continued inactivity through protracted repose of the limb. These two causes produce similar effects upon the muscular fibre, the proximate cause of contraction being the same. Whether this variety be combined with structural shortening or not, it is the most amenable to the operation of mechanical means, although, when the structural shortening is very considerable, the division of the tendons will in many instances be necessary, as in Case I.

It is well known that when a limb remains for a considerable period in a state of inactivity, the muscles waste, and ultimately fall into what is designated the state of atrophy. Atrophy is likewise produced when the muscles, from whatever cause, continue contracted during a long period. A degener-

ation of the fibres of the muscles is considered to be an ordinary condition or consequence of this state. This physical alteration of the muscles is termed the fatty degeneration. My experience in the treatment of contractures and deformities of various parts of the body, combined with the observations elicited by dissection, lead me to conclude either that this degeneration of muscular fibre is comparatively rare, or that the inactive state of the muscles (by which I mean the cessation of the alternate contractions and relaxations of the muscular fibre) must have been of great duration before it could have been engendered. I doubt, indeed, whether the muscular fibre be ever completely transformed so as to be incapable of a renewal of its actions, through the mere inactivity of the limb or cessation of the alternate relaxation and contraction of the muscle. Structural shortening of the muscle may have taken place, particularly if the contracture of the limb existed in early life, at the period when the process of removal, renewal, and growth of parts is most rapid;* but the diminution of the length of the muscular fibres, and of their consequent capability of extension to the normal length of the muscle, may be remedied, either by the persevering use of mechanical instruments or by the division of their tendons. The flexibility of the joint is restored by either of these means, and the most powerful stimulus to resume its function is applied to the newly lengthened muscle by the consequent alternate tension and relaxation to which it is subjected by exercise of the limb.

As we find that after division of the tendon of the gastrocnemii muscles for the cure of a contracted foot, the extremities of the tendon re-unite through the medium of a firm band of ligamentous or cartilaginous tissue, which tissue is of a length corresponding with the previous degree of deformity and attendant elevation of the heel, it might be inferred that the belly of the muscle would not in walking be subjected to this alternate tension and relaxation, and

* See Cyclopædia of Practical Surgery, Supplement to article "Ankylosis," by W. J. Little, M.D.

that it would consequently remain at rest, and exercise as little of its function of contraction as before the operation. This is the case, in fact, during a few weeks. But when the patient is able more fully to exercise the limb with the ankle bent to its proper extent, the lymph uniting the tendon undergoes that consolidation and process of contraction which invariably ensue during the organisation of adventitious tissues, or after that process is completed. This process advances slowly; and as the reproduction of the deformity is prevented by the exercise taken by the patient, and in some cases by wearing a mechanical instrument at night-time, the belly of the muscle, if it be susceptible of elongation, is stretched out. But if the wasting of the muscle and structural shortening have been preceded by spastic contraction of the muscular fibres, and are coexistent with it, the contracting process of the organised lymph uniting the divided parts of the tendon will be prevented, the lymph being held in a state of extension between two opposing forces, namely, the belly of the muscle still spasmodically contracted, and the resistance offered to any elevation of the heel taking place by the pressure of the toes against the ground.

I have, however, occasionally observed, in cases where spasmodic contraction of the muscle had been the original cause of the deformity, that the muscle has been restored to its function, on division of the tendon, after the consolidation and contraction of the lymph uniting the divided ends had taken place. I am of opinion that when this occurs, the spasmodic contraction, the original cause of the deformity of the muscle, has subsided in consequence of the cessation of the disturbance in the nervous system by which it had been produced; and that the contraction of the muscle with which I had had to contend was merely the result of its long-continued inactivity and consequent structural shortening. This phenomenon is analogous to a circumstance occasionally observed when the muscles of a limb have been long paralysed, and the cause of paralysis residing in the nervous centres has ceased. In this instance the weakness of the limb may be so great, owing to the length of

time during which its muscles have been in a state of total inactivity, as to induce the supposition that the patient still labours under nearly the same degree of paralysis, being perhaps unable to impart to the limb more than a few motions of the fingers or toes, and some irregular movements of the arm or leg; whereas by exercise the limb becomes restored, so that the patient can exert volition with a certain precision and force. Much permanent weakness of the limb may nevertheless remain, depending upon the length of time its functions had been suspended.

CASE III.

TALIPES EQUINUS ACQUISITUS OF THE RIGHT SIDE.—(Fig. 2.)

Non-congenital club-foot, arising from paralysis of the tibialis anticus and extensor longus digitorum muscles; consequent contraction and structural shortening of the muscles upon the posterior aspect of the leg and foot. Cured by division of the tendo Achillis, and elongation by mechanical means of the resisting structures not divided by the knife.

June 20th, 1836. * * aged 11 years, was brought to me for the cure of a lameness of the right leg, which has ensued since birth. His mother states that he was perfectly strong in the limbs until the age of four years, when, after an attack of scarlet fever, she noticed that he had partly lost the use of the right leg and arm; and that he was unable to tread firmly with the affected foot, but "dragged it after him;" and that he could not grasp objects with the same strength as before the attack. He gradually recovered from the general debility produced by the fever, and regained the use of the arm, although it remains weaker than that of the opposite side. He was soon enabled to use the affected leg: but it was noticed, that instead of putting the heel to the ground, he walked solely upon the toes. The deformity has gradually increased, the elevation of the

heel now being four inches (see fig. 2, page 3, taken from the subject of the present case.) The whole of the extremity is much smaller than that of the opposite side, the leg particularly so, the tibia and fibula being more slender, and the difference in length about three-quarters of an inch less; in that of the foot, half an inch less. The extension of the foot is so great, that the tarsus and metatarsus form a straight line with the leg, the weight of the body being borne by the anterior extremities of the metatarsal bones. The skin of the part on which he treads is tender, and covered with a dense cuticle, of sufficient thickness beneath the extremity of the metatarsal bone of the little toe to constitute a corn, which proves a source of great suffering when he walks the distance of about a mile, in consequence of the inflammation induced at its base by the pressure and friction. The form of the tarsal bones is unaltered, although their relative position has become affected by the causes of the deformity; thus the tibio-tarsal articular facets of the astragalus are felt beneath the skin of the instep, owing to the extreme state of extension of the foot: the round head of the astragalus can also be seen upon the dorsum of the foot, through the anterior row of tarsal bones and the metatarsus being drawn backwards towards the sole by the contraction of the flexor muscles of the toes and of the muscles of the sole of the foot. Although, when the patient stands carefully upon the affected foot, he appears to tread evenly upon the ends of all the metatarsal bones (see fig. 2), nevertheless, in walking, owing to the laxity* with which the astragalus articulates with the tibia and fibula when the foot is in an extreme state of extension, the tarsus is much disposed to yield outwards and the toes to turn inwards; consequently, the weight of the body is received chiefly by the metatarsal bones of the little toe. This outward tendency of the tarsus, accompanied with the inward inclination of the toes (the weight of the body being consequently thrown upon the

* The looseness of the ankle when the foot is in a state of extreme extension arises from the narrow part of the superior articular surface of the astragalus being then situated between the two malleoli.

metatarsal bone of the little toe), is a great cause of vacillation in the patient's gait, greatly increasing the danger of falling should he accidentally tread upon a pebble or any inequality of surface. Being thus constantly liable to stumble, which danger is increased by the weakness of the muscles of the whole extremity, he seeks to maintain the equipoise of his trunk by moving the opposite arm from his side, in the same manner as an individual endeavours to preserve his balance whilst walking upon a suspended plank, or the edge of a curbstone.

It has been mentioned that the tibia of the affected leg is nearly an inch shorter than the other; but as the heel of the lame foot is raised four inches, the length of the extremity is consequently augmented to the extent of three inches. This is another source of the fatigue endured by the patient when walking, and of the unsightly nature of his gait; the alternate jolting of the trunk of the body from the lengthened extremity to its shorter companion occasioning violent shocks to the whole frame.

The present condition of the muscles of the extremity assists in illustrating the nature of the affection. The muscles of the thigh are less developed than the corresponding ones of the left side: the patient exercises voluntary power over them, consequently their comparative weakness does not at present depend upon paralysis; it probably arises partly from the injury sustained in their development during the period of the more general paralysis of the limb, and partly from the thigh not being called into natural activity in consequence of the principal exertion in walking having devolved upon the sound leg. The gastrocnemii and other muscles of the leg have attained a much less degree of development than natural; the belly of the former is short compared with the length of the tendo Achillis; which shews that no "shortening" of that tendon exists, but that the muscle is in a state of contraction. As that contraction has reached its fullest extent, and is so rigid that the surgeon cannot stretch the muscle with his hands, it is clear that the patient is unable to exert any

voluntary power over it. The tibialis anticus muscle is perfectly paralysed; for although there is considerable mobility of the ankle-joint, and the surgeon can, by endeavouring to press the toes in an upward direction, restrain the action of the gastrocnemii, and thus facilitate that of the tibialis anticus, provided it possessed the power of contraction, still the patient is unable to make the slightest movement of the foot upwards, nor can the surgeon, with his fingers placed upon the belly of the muscle, feel the least contractile motion of its fibres. The patient cannot extend the four smallest toes, although he can raise the outer margin of the foot by means of the peronei muscles, and raise the great toe through the action of the ext. proprius pollicis. The whole of the toes, more particularly the great toe, are in a state of mechanical extension, owing to the stretched state in which all their tendons are maintained through the anormal position of the foot.

The patient is in the enjoyment of good health, free from any appearance of scrofula or other hereditary disease, of a mild, amiable disposition, and of sedentary habits. His growth has evidently received a shock from the same cause by which the right arm and leg have been affected. This is strikingly manifested on comparison with his brother, who, although two years younger, is much taller and stouter. The injury to the nervous system evinced by the former hemiplegia has not therefore been limited to a disturbance of the voluntary and involuntary motor powers of the limbs of one side, but has likewise extended to the ganglionic or nutrient system of nerves.

June 25th, 1837. I divided the tendo Achillis, in the manner described p. 30; the puncture was on the following day found to be united, and on the second day I applied Stromeyer's foot-board (see fig. 13.)

The extension was pursued without the occurrence of any interruption until July 10th, when the bending of the ankle-joint nearly equalled that of the sound limb, the foot being in relation to the leg at an angle of 70 degrees. He had complained of very little pain, although, like many

young patients, he was very anxious to have the apparatus removed, and was frequently in the habit of loosening the straps after my visit. He had been allowed from the fifth day after the operation to walk about the apartment, with the leg remaining in the foot-board; but as that apparatus is not very convenient for the purpose of locomotion, and perceiving the possibility of his striking the end against a chair or table so as to occasion a fall, I exchanged it for a shoe, on which two thin iron stems were fastened, one on either side, to extend along the internal and external surfaces of the leg. The part of the instrument adapted to the reception of the foot could be inclined at any angle with the leg, by means of a screw upon each side, such as is represented fig. 14. Through this contrivance the remainder of the stretching necessary to bend the joint could be accomplished.

July 14th. The foot has now acquired the normal shape, and can be bent to the fullest natural extent. The chief point at which he has felt any pain has been the internal malleolus, which is slightly reddened. This pain and the redness are produced by the necessary elongation of some of the fibres of the deltoid ligament, and have been relieved by the application of the spirit lotion. The only necessity for the continued application of the extending apparatus arises from the greater weakness of the inside of the ankle-joint compared with the outside, and which allows the tarsus to yield somewhat internally, causing it to resemble the state of the ankle commonly denominated valgus: this renders the wearing of the apparatus prudent for some time longer, for the purpose of supporting the joint and permitting the bones and ligaments to accommodate themselves to the altered relation of the parts. With reference to the mere act of walking (which in these cases is a secondary object until the foot be restored to the attainable degree of mobility), no mechanical support was required, as he walked better without such assistance.

July 20th. My attention has been drawn to a symptom which I have noticed in several similar cases (see Case I. and

"Remarks" appended to it), namely, that on throwing the weight of his body upon the limb, so as to keep the ankle bent, the phalangeal extremity of the metatarsal bone of the great toe is forcibly drawn to the ground, which causes the skin covering that part to be painfully compressed. This arises principally from the resistance opposed to the bending of the ankle by the flexor longus pollicis muscle. The elevation of the heel occasioned by the contracted muscles of the calf having been removed by division of the tendo Achillis, and the contraction of the tibialis posticus muscle having been comparatively quickly overcome by the use of the extension-apparatus (owing to the insertion of its tendon being nearer to the axis of motion in the joint), the flexor longus pollicis muscle acts visibly in drawing the ball of the great toe to the ground. In short, the tendon of this muscle can be felt to be very tense in the sole of the foot. I have therefore directed a thick piece of leather, spread with empl. plumbi, with a round hole made to receive the projecting inferior extremity of the metatarsal bone, to be applied over the ball of the great toe, to protect the skin from the effects of pressure and friction. As the flexor longus pollicis and peroneus longus muscles are the only remaining obstacles to bending the joint, and consequently have to bear in walking the stress of the body, I have desired him to take much exercise to effect their necessary elongation. This will, moreover, stretch the muscular and ligamentous tissues of the sole of the foot, and thus assist in overcoming the unnatural superior convexity and inferior concavity of the tarsus peculiar to these feet.

August 7th. The projection of the ankle inwards, and the forcible drawing down of the ball of the great toe, are diminished. He has obtained greater freedom of using the joint. Within the last few days I have recommended the discontinuance of all mechanical support during the day, with the exception of a piece of whalebone sewn on the inner side of an ordinary lace-up boot. This will serve the double purpose of supporting the weak inner ankle, and, by impeding the fall of the foot beyond a right angle with the

leg, will supply the place of the paralysed tibialis anticus muscle. As the extension-apparatus had long ceased to cause pain, I requested that it might be worn during the night, in order to obviate the possible occurrence of contraction of the lymph which unites the divided tendon, whilst undergoing the process of consolidation and complete organisation which it ultimately attains.

On the discontinuance of my regular attendance for the surgical part of the cure, I suggested a plan for the removal, if possible, of the cause of the paralysis. I requested that he should be brought to me at short intervals, that I might point out any circumstance requiring attention, and stimulate him to the necessary exertions in the improvement of his carriage and mode of walking. Upon attention to these particulars depends the great perfection of many cures of this deformity.

Several months elapsed before I again saw this patient, in consequence of his having been sent into the country to school, contrary to my recommendation. I feared that, from being so thoroughly pleased at the exceeding facility with which he could stand, walk, or run, that no further progress would be made; indeed, I was somewhat apprehensive of a tendency to relapse. On this occasion I found him wearing a common boot, and walking very well, although it occurred to me that he did not bend the foot, in the act of walking, quite as fully as when I last saw him. I perceived, however, that this depended partly upon his inclination, and that very slight pressure with my hand against the sole of the foot sufficed to give it its full extent of flexion. I was subsequently informed by a medical friend, that he had heard that my patient had relapsed, and was walking very badly. It is necessary to mention this, in order to point out the unjustifiable anticipations entertained by thoughtless persons respecting new remedies and operations. The father of the young gentleman assured me, a few weeks since, that his son could, when he pleased, walk almost as well as himself; but because a person whose entire frame had still retained some of the effects of the shock of paralysis, and who had

required division of the tendo Achillis to obtain the proper use of a limb, exhibited some trifling limp in his gait, the operation had been regarded as a failure!

Remarks.—The indications of cure were in this case two-fold; namely, first to overcome the contraction of the muscles upon the posterior part of the leg, and of any other tissues which might resist the bending of the foot; and afterwards to endeavour to remove the paralysis, the primary cause of the deformity. As the deformity had existed during several years of that period of life when the renewal and growth of all the healthy parts of the frame is most rapid, I did not doubt that the posterior muscles of the leg, from having been contracted during so long a period, had, in addition to the alteration of their dynamic state, also become physically changed; in other words, that the muscular fibres, in addition to their usual state of contraction when in action, had undergone structural shortening to the extent of rendering impossible their elongation by mechanical means, unless the power applied were sufficient to produce rupture of the fibres, or its use continued for a period which would render most improbable the requisite patience on the part of the sufferer, and the continuance of the extraordinary attention and perseverance of the parents and attendants.

The first part of the cure, namely, that of overcoming the resisting tissues, was therefore required to be accomplished by division of the tendo Achillis, with which the bulk of the muscles, the gastrocnemii, upon the back of the leg, is connected; and by stretching, by means of appropriate mechanical apparatus, the tibialis posticus muscle, the flexor muscles of the toes, and those ligaments and fasciæ around the ankle-joint which might be found to impede its bending. The second part of the cure which was indicated consisted in endeavouring to remove the paralysis of the anterior muscles of the leg, and the slight general enervation of the limb, by internal remedies, frictions, manipulations, electricity, and counter-irritation.

I have already alluded to the circumstance of this young

gentleman being addicted to loosening the apparatus after my visits; and I again mention it, for the purpose of warning others of its probability during the management of similar instances of distortion. It was fortunate that the case was not difficult; the resistance to the bending of the ankle offered by the ligaments of the joint, the posterior tibial muscle, and the flexors of the toes, having been slight: had the difficulty in this respect been greater, it is probable that the cure would have been less complete. The blame in this, as indeed in all instances of disobedience to the directions of the surgeon, must be attributed to the attendants.

In the cure of these distortions, whether an operation be requisite or not, nature effects but little—a course contrary to that observed in the generality of medical and surgical diseases. But as art possesses the merit of accomplishing nearly the whole of the results obtained by the Stromeyerian method of cure, nothing short of the most careful attention and unremitted perseverance will ensure success in the majority of instances. The patient should be visited early in the day, for the purpose of increasing the power of the apparatus, or for that of securing anew those straps and bandages which become relaxed during the gradual restoration of the foot to its proper form. He must also be attended during the evening, for the purpose of diminishing the action of the apparatus, that he may sleep with the least possible disturbance, as a succession of restless nights might interfere with his general health.

The precaution of allowing the patient to wear some support to retain the foot a certain time in its newly acquired position, is the more necessary, because the probable occurrence of the contraction peculiar to all tissues of recent organisation is increased, in cases similar to that just described, by the absence of the anterior tibial muscle to counteract this tendency; and where the patient, being young, is not likely to give the attention required, nor to take the necessary trouble daily to bend the ankle-joint to the fullest extent at stated times during a few additional weeks.

After the existence of the deformity of Talipes for several

years, the imperfection of gait and carriage is not unfrequently aggravated by the consequent elevation of the pelvis upon the affected side, and likewise by a slight lateral curvature of the spine, induced, like the obliquity of the pelvis, by the trunk resting upon two extremities of unequal length. All the muscles of the trunk and legs, and even those connected with the upper extremities, acquire certain unsightly associated actions by the continuance of the deformity. It is therefore not surprising sometimes to find after the cure of the foot,—the extremities being rendered of equal length, the pelvis having righted itself, and the spine having spontaneously become straight,—that a considerable time elapses before the muscles of the trunk entirely lose their accustomed actions, and cease to give to the gait and carriage those peculiarities observed in persons affected with some species of Talipes.

The curvature of the spine here pointed out, and which is a consequence of the deformity of the foot, must not be confounded with that which I have often seen co-existing with Talipes, and which is only an additional symptom of that derangement of some part of the medulla spinalis which has given rise to the deformity of the foot. In my opinion, this curvature of the spine depends, like Talipes, either upon spastic contraction of the muscles of the concave side of the distorted vertebral column, or upon paralysis of the voluntary or involuntary contractile power of those upon the convex side.

I would add, that no limit can be assigned to the period beyond which the patient is unsusceptible of further improvement. Of my earliest patients cured of deformities of the limbs, there is scarcely one in whom I have not continued to witness improvement.

CASE IV.

TALIPES EQUINUS ACQUISITUS.

Non-congenital contracture of the left ankle (club-foot), arising from paralysis of certain muscles of the limb; consequent contraction, and susbequent structural shortening of the muscles on the back of the leg. The deformity and the greater part of the lameness cured by division of the tendo Achillis.

July 6th, 1838. Mrs. ****, ætat. 30, states that at the age of twelve months she was, without previous indisposition, attacked with paralysis of the left lower extremity. Contraction of the muscles of the calf gradually ensued. She has been unable to place the heel to the ground for 25 years, having successively walked upon the ball of the foot and the anterior extremity of the metatarsal bone of the great and of the little toes. The temperature of the limb is lower and the foot smaller than the other, the front of it having the square form peculiar to Talipes equinus. The great toe, very imperfectly developed, is in a state of extension, and rests upon the second toe, as represented in the figure accompanying Cases XVIII., XIX., and XX. These circumstances give to the foot the appearance of congenital deformity, in opposition to the patient's statement of the origin of the lameness. There is great lateral mobility of the ankle-joint, although the front of the foot cannot be bent upwards. This mobility permits the front of the foot to turn freely either inwardly or outwardly, which is the cause of her occasionally treading upon either the great or little toes; but from the projection of the inner ankle and the diminution of the arch of the tarsus, it is apparent that the inclination of the point of the foot is greater outwards. The ligaments of the hip and knee-joints, and their respective muscles, do not possess ordinary firmness; and there consequently exists a looseness in the motions of these articulations. The knee has sustained additional injury through the action of walking, the internal lateral ligaments having particularly suffered from the strain

constantly exercised on them. Owing to elongation, they allow the condyles of the femur and upper part of the tibia to yield inwards, by which the lameness is greatly aggravated. This alteration in the relative position of the extremities of these bones, combined with the diminished tone of the muscles, cause the patella to slip occasionally over the outer side of the external condyle.

July 9th, 1838. The tendo Achillis was divided in the manner already described; the puncture united within 48 hours, and on the third day Stromeyer's foot-board was applied. Slight extension sufficed to bend the foot to a right angle with the leg; little pain and irksomeness were experienced from wearing the apparatus. The advance of the foot beyond the right angle was attended with greater difficulty. The patient complained of pain in the front of the articulation, and upwards in the direction of the peronei tendons behind the fibula. Considerable œdema of the foot and leg supervened, with ecchymosis beneath the inner ankle, produced by the stretching to which the skin of this part was subjected during the further bending of the foot.

The complete restoration of the form and mobility of the foot was obtained within a month after the operation; the existence of the œdema and tenderness of the joint, in addition to the necessity of obviating the occurrence of any contraction in the tissues which had been extended, rendered indispensable the wearing of a *retentive* apparatus. The inward tendency of the ankle observed before the operation became more evident after the complete bending of the foot, which then partially presented the appearance of Talipes valgus. The *retentive* apparatus consisted of a shoe similar in principle to that represented in fig. 14; but in consequence of the projection of the inner ankle, combined with the tendency to T. valgus, the springs were attached to the inner side of the leg, instead of being placed on the outer side, as represented in this figure. The patient was enabled to take daily exercise whilst wearing this apparatus, although with difficulty, in consequence of tenderness of the joint,

and the sensation of shortness in the leg, occasioned by the heel having been allowed to reach the ground. At the expiration of two months from the period of the operation, she was permitted to wear a common lace-up boot, with the addition of an iron stem upon the outside of the limb, to support the ankle during the mutual accommodation of the parts affected by the altered position of the tarsus. As the œdema did not appear entirely to depend on local causes, its removal was facilitated by the occasional administration of aperients and the continued exhibition of sulphate of quinine combined with a generous diet.

Oct. 1st, 1838. She walks at present with great ease in comparison with the difficulty formerly experienced, although having still the appearance of lameness; this is sufficiently explained by the weakness of the inner ankle and the condition of the hip and knee joints already described, and by a trifling shortening of the extremity. I have recommended a mechanical support adapted, by means of a spring, to assist the weak extensor muscles of the knee in straightening the leg, and to arrest the inward inclination of the joint. I have given the assurance that her gait will by these means be rendered much firmer, and that as the limb is at present restored to an aptitude for action by possessing the natural flexibility of the ankle, and by affording a firm pillar on which the weight of the body can be borne, increased strength will daily be gained by exercise.

Remarks.—This case is not related as a striking illustration of the results of the divison of tendons, but rather to demonstrate the great advantage which may be gained even in apparently unfavourable cases. Although the *removal* of *deformities* of limbs arising from paralysis of certain muscles, presents fewer difficulties, from a less powerful extending apparatus being necessary, and its use requisite for a shorter period, than in the deformities arising from spasmodic contraction of muscles; still, the *cure* of the *lameness* is less complete, as the paralysis which led to the production of the deformity frequently remains, notwithstanding the greatest

exertions. But the surgeon who may not have witnessed the treatment of cases similar to those numbered I., III., and IV., would scarcely conceive the extent to which the *deformity* arising from paralysis may be remedied, with or without operation according to the circumstances of the case, and the remaining lameness concealed by simple mechanical apparatus. This is shewn in the instance of paralysis of the anterior muscles of the leg, where the patient, by wearing a common lace-up boot stiffened on the sides with extra pieces of leather or a thin steel busk, to limit the motion of the ankle in the direction of extension—thus preventing the falling of the toes,—is enabled to walk a considerable distance with only a slight appearance of lameness. Many persons who have applied to me affected with deformities arising from paralysis, and who have obtained a cure, doubted the possibility of any relief, so irremediable have they regarded their affliction, from the concurrent testimony of various practitioners.

In the instances of deformity resulting from paralysis, the contraction gradually supervenes, and a considerable length of time expires before the deformity reaches the stage at which it is presented to the surgeon for relief. This slow progress of the deformity is attributed (the nature of its origin being unheeded) to increasing weakness and comparative uselessness of the limb.

When one or more of the muscles on one side of the limb are affected with paralysis (*quoad* volition), the limb becomes distorted by the slow contraction of the muscular fibres on the opposite side. When the whole of the muscles of the extremity have suffered a diminution or entire privation of motor voluntary power (the reflex, and the organic, or involuntary contractility of the muscular fibres remaining intact), and deformity results, the distortion of the limb takes place towards that side where the greater mass of muscles is situated. The articulating surfaces of the bones of the knee and ankle-joints are displaced, from their not being retained in the proper state of firm approximation by their respective muscles, whether this arises in consequence

of some of the muscles being paralysed, or through all of them being partially or entirely deprived of their proper tone. This alteration in the relation of the articulating surfaces of the bones is aggravated by the yielding of the ligaments consequent on the unnatural strain to which they are subjected when the weight of the body is thrown upon the limb.

Although we may frequently be disappointed in the hope of curing paralysis of particular parts of the lower extremities, an improved knowledge of the manner in which deformity takes place in limbs thus affected may nevertheless enable us to anticipate and prevent it; and should deformity unavoidably occur, we have the gratification of knowing that we can, by a very simple operation, overcome the muscles secondarily contracted, and restore the limb so as to enable it to resume its most useful function, that of serving as a pillar for the support of the trunk.

By attention to the manner in which injury to the bones and ligaments, and the contraction of particular muscles, occur, in cases of partial paralysis of the lower extremities, the deformity which would otherwise result may be entirely prevented. The treatment to be resorted to for this purpose consists of the application of an apparatus adapted to support the joints, which are liable to yield beneath the superincumbent weight of the body, and to retain the articulations in such positions as will be most useful to the patient in the act of walking. If paralysis of the anterior tibial muscle or of other muscles on the front of the leg exist, the apparatus should consist of an iron stem, fastened either to the inner or outer side of the shoe, according as the ankle may be inclined to yield inwardly or outwardly, and attached beneath the knee by means of straps. This will support the ankle-joint. Extension of the foot should not be permitted beyond a right angle with the leg, in which position the patient is enabled most conveniently to walk, and which can be effected by any slight mechanical contrivance which may suggest itself to an ingenious surgical mechanist. If the muscles of

the thigh be affected, and it be apparent that the articulation of the knee is liable to suffer from the want of power in the muscles, an apparatus should be worn upon the knee calculated to obviate the inward or outward inclination which takes place through relaxation of the ligaments. The apparatus should be constructed of a frame-work of iron, having a joint corresponding to the articulation of the knee, with a spring adjusted to assist the muscles weakened by the paralysis when partial, or to supply their place if the paralysis be complete.

There exists a great repugnance, both on the part of parents and of many members of our profession, to the application for a lengthened period of mechanical instruments ("irons"). This arises partly from fear of the growth of the limb being impeded by the compression exercised by straps and bandages, but more particularly from the inefficiency of the apparatus usually resorted to. I will not venture to deny the *possibility* of compression interfering with the development of a limb, but I entertain a great doubt whether the emaciation observed in patients who have for a long time worn mechanical instruments has arisen from the compression exercised by them. We are aware of sufficient causes of the atrophy of limbs affected with paralysis —in the very fact of its existence—without the necessity of referring it to injury produced by the use of instruments. It is remarkable in the cases of two persons, the cure of whose deformity is related in this treatise (see Case XXII. and the *Remarks* appended to it), that atrophy of the affected limbs had reached the greatest extent I have ever witnessed, although they had never worn instruments.

But in these and similar cases, unless the generality of the members of the profession suggest the construction of the necessary apparatus according to the anatomical and pathological peculiarities of the case, superintend its application, and continue the same degree of attention which they bestow on any chronic medical or surgical complaint, we shall still be compelled to regret the inefficiency of mecha-

nical instruments, with the probable addition of injury having resulted from their application.

I can confidently assert, that the deformity for the cure of which the subjects of Cases I., III., IV., XX., and XXII. required the performance of an operation, might have been completely obviated by the application of very simple mechanical apparatus, had it been commenced at the period when the paralysis could reasonably have been considered incurable. The method I am accustomed to recommend, when consulted shortly after the commencement of paralysis in children, is to attempt its removal by the remedies usually adopted, namely, the administration of purgatives, "alterative" doses of mercurials, preparations of iodine, iron, and bark, according to the nature of the origin of each particular case. We should also resort to electricity, frictions, counter-irritation to the spine and the affected extremities, and also to manipulation of the limb, consisting of alternately moving the joints forwards and backwards to the full extent of flexion and extension, to obviate the insidious approach of contraction of the muscles and the consequent deformity. This manipulation should be daily resorted to at repeated intervals, in order that the patient may be enabled to walk without injury to the bones and ligaments of the knee and ankle-joints. Mechanical apparatus should be applied, constructed on the principle already alluded to, and which is still more indispensable when we have reason to believe the paralysis incurable.

A very simple treatment for a short period often suffices to cure the paralysis with which children are occasionally attacked in the progress of dentition; and if care be taken that no contraction of any muscles be permitted to ensue during the continuance of the paralysis, the limb on cessation of the paralysis will by exercise quickly be restored to its function. But should any contraction of the muscles have taken place, through neglect of the necessary treatment during the continuance of the paralysis, the consequent deformity (elevation of the heel, in cases where the anterior muscles of the leg have been paralysed) daily increases to

such an extent, that after the lapse of a few years the child must undergo a tedious treatment by mechanical apparatus to overcome the contraction of the muscles, or the only alternative, division of the tendons.

To return to the case preceding these "*Remarks*," I may allude to the external resemblance described to exist between this case and congenital Talipes. I do not intend to convey the impression that the deformity was congenital, for there exists the information relative to the origin of the lameness, which is corroborated by my own observation, as I have never witnessed a case of congenital Talipes the source of which I could attribute to paralysis.

The œdema of the limb which supervened was greater than in any other case of Talipes on which I have operated. The same observation applies to the ecchymosis I have described as having taken place beneath the internal malleolus. Both these occurrences depended rather on the relaxed condition of the capillary system in general than on the degree of compression in the circulation of the limb necessarily produced by the straps of the apparatus, as the exercise of very moderate extension sufficed to bend the ankle to the proper degree. The supervention of œdema served, however, to extend the time required to effect the cure of the deformity, as the tendency to excoriation always existing in these cases rendered it expedient to proceed more slowly with the extension.

At the period of five weeks after the operation, when the complete bending of the ankle had been obtained, there was a great similitude between this foot and Talipes valgus. This resemblance depended on a cause similar to that by which the latter is produced. Talipes valgus, in its complete form, consists of a threefold alteration in the position of the foot, the reverse of T. varus (see page 4). Previously to the performance of the operation, there existed in this case an inward tendency of the ankle, the point of the foot being directed outwards, arising from the laxity of the internal lateral ligament (l. deltoideum) of the ankle-joint, produced by the distortion of the knee. The deformity of

the foot before the operation, having a paralytic origin, depended on contraction of the *whole* of the muscles upon the back of the leg: when the tendo Achillis was divided, and the foot bent to the fullest extent, the muscles whose tendons remained undivided on the back of the leg could thus influence the form of the foot according to their peculiar situations and attachments, and more particularly as the form of the bones which compose the ankle-joint, in addition to the state of the ligaments, facilitated this result. The muscles on the front of the leg being paralysed, the gastrocnemii being rendered inoperative by the division of their tendon, and the ankle bent to the fullest extent, the foot was thus entirely left to the influence of the tibialis posticus, flexor longus digitorum, flexor longus pollicis, and the peronei muscles. When the apparatus was removed, each of these muscles could exercise its peculiar influence on the joint, in consequence of the laxity of the articulation; for had the astragalus been accurately *dove-tailed,* or, more properly speaking, *wedged,* between the tibia and fibula, no tendency to T. valgus would have existed. The tension of the tibialis posticus was neutralised by the inward tendency of the astragalus which had previously existed. That of the flexor longus digitorum could act comparatively little in directing the foot either inwards or outwards, and not in the least by raising either the inner or outer margin of the foot, in consequence of the tendons of this muscle being *distributed* over the sole of the foot. There remained but the flexor longus pollicis and the peronei the tension of which could, under the existing circumstances, impress the foot with the form of T. valgus; it was the former muscle which tended to draw the ball of the great toe firmly to the ground, whereas the peronei not merely inclined the patient to walk on the inner margin of the foot, but completely raised its outer edge.

Had this newly acquired malposition of the foot been incapable of removal by the hand, I should have suggested the division of the tendons of those muscles which were the cause of the deformity: the contrary being the case, I

recommended that she should wear for a few months the mechanical apparatus already described. I have no doubt that exercise, the limb being held in its proper position, will overcome the tendency which the flex. long. pollicis and the peronei have to cause the patient to tread unevenly, and will gradually effect a great amendment in her manner of walking.

CASE V.

TALIPES EQUINUS CONGENITUS.

Club-foot of the right leg, produced by spasmodic contraction of the muscles of the calf. Cured by division of the tendo Achillis.

The particulars of this case were published seven weeks after the operation by the gentleman who was the subject of it. His testimony in favour of the method of curing these deformities by division of tendons is of great value, inasmuch as he is a member of the medical profession, and has, during the many years he has been engaged in medical practice, devoted himself to the attainment of relief. From the period of his infancy, he had been placed under the care of different mechanists, and was also long under the treatment of a gentleman, now deceased, who was renowned for the cure of these deformities—Dr. Cheshire, of Hinckley, in Leicestershire. He is therefore perfectly competent to decide upon the merits of the application of mechanical means alone towards effecting a cure of his own and similar cases. I prefer, as in Case II., republishing the letter alluding to his case and the method of treatment, instead of relating the report on the subject from my diary.

*To the Editor of the Lancet.**

"Sir,—Having observed of late several cases recorded in the Lancet of deformities of the feet cured by dividing the

* Vol. i., 1837-38, p. 184.

tendo Achillis, I beg leave, in support of that very useful and simple operation, to publish my own case.

"I laboured under contraction of the gastrocnemii muscles of my right leg from my earliest years. When standing erect, my heel was about an inch and a half from the ground; and when I walked, almost the only part of my foot that touched the ground was the ball of the little toe. I was obliged to use a stick, and suffered great uneasiness. I went to London, and placed myself under the care of Dr. Little. This gentleman, whose numerous operations of this nature have brought the subject of curing these deformities *surgically*, fully under the notice of the profession in your columns, suffered, as you are aware, from the same lameness, and had the operation of dividing the tendo Achillis performed upon himself by Dr. Stromeyer, in Hanover, the inventor of the method, about fifteen months ago. Dr. Little, to whom I beg in this, the most public way in my power, to offer my grateful acknowledgments for his kindness and attention while under his care, performed the operation * * * * on the 11th of August last. I sat upon a sofa; one assistant supported my knee, and another held my foot, and endeavoured to bend the ankle as much as possible, so as to render the tendon tense; while Dr. Little, resting one knee upon the floor, passed a narrow curved bistoury across the tendon, between it and the deep vessels, nerves, and muscles, from within outwards, about two inches and a half above the os calcis, and divided it in withdrawing the instrument. As soon as the tendon was divided, it gave a crack, which was distinctly heard by all those around, and the separated ends of it could be easily felt with the fingers. The foot was bandaged, and allowed to remain at rest till the 14th, when the small puncture having cicatrised, the foot-board was applied to make the necessary extension. The heel came gradually down, and on the 17th the foot was nearly at a right angle with the leg. A few days later the foot was as much bent at the ankle-joint as that of the opposite limb. I have been walking about for the last four weeks. I find my limb acquiring

both strength and substance; and the condition of the gastrocnemii and other muscles enables me to stand upon the limb, and move it in every natural direction. I may now say, that I am not only free from deformity, but enjoy an ease, freedom, and power in locomotion, such as it was never my lot to enjoy at any previous period of my existence. I consider it a duty I owe to Dr. Little, and to society, to request you will insert this concise statement in the next number of your journal.

"I am, Sir, your most obedient servant,

"THOMAS INGLIS, M.D.

"178, *George Street, Glasgow, Oct. 3rd*, 1837."

Remarks.—Persons who are unacquainted with the nature of club-foot and similar contractures, are unable to form any accurate idea of the pain and fatigue endured by those who are afflicted with only a trifling deformity of this species. There even are cases in which there is scarcely any appearance of deformity, where the affection consists merely of an elevation of the heel to the extent of an inch and a half—as in the instance just related, or where, in fact, the contracture may be even more slight, as in Case VI., and the individual may nevertheless experience much difficulty in walking. Indeed, it will often be found that the actual amount of pain and fatigue is greater in slight cases of Talipes than in those wherein the deformity has reached the highest grade. Thus, the individual who was the subject of the deformity represented in figures 5 and 6 suffered no pain in walking, because the foot, although so frightfully distorted, presented a proportionally large surface of the back of the instep to the ground. The effect of attrition and pressure upon the skin of the part thus unnaturally exposed to injury, had been the gradual thickening of the cuticle and enlargement of the subcutaneous tissues, to the extent of forming a large globular swelling, which served as a cushion to sustain the weight of his body, and prevented the occurrence of any pain.

An incident worthy of allusion in the history of the case

of Dr. Inglis, and which that gentleman has modestly omitted to mention in the letter I have republished, is interesting with reference to the priority among British practitioners in the performance of the operation of dividing the tendo Achillis.

Fifteen years since, and prior to the commencement of his medical studies, he became convinced, solely from his sensations, uninfluenced by any anatomical knowledge, that his lameness depended upon a shortening of the tendon behind the heel, and consequently that if that were cut his lameness would cease, by the heel being allowed to reach the ground. He communicated his opinion and suggestion to the medical attendant of his family, who discountenanced them, and explained to him the danger which he supposed would arise from the division of a tendon, and especially of that of the tendo Achillis, and advised him to abandon the idea of his lameness being curable. Not being discouraged by this adverse opinion, he communicated his ideas to other members of the profession; they, however, concurred in the advice given by the physician first consulted. Being still dissatisfied with the decision, he determined to put in execution his own project; and contriving an appropriate apparatus for drawing down the heel, he secretly divided the tendo Achillis with a surgical instrument. Considerable bleeding ensued; his family were soon aware of the circumstance, and directly sent for their medical attendant, whose advice had been so pertinaciously rejected. That gentleman treated the patient as monomaniac (certainly not without some reason, as he was ignorant of the safety of dividing large tendons, even with the greatest skill and care bestowed upon the operation); and ordered the careful adjustment of the lips of the wound, so as to obtain cicatrisation. The treatment subsequently pursued was that deemed applicable to an accidental division of the tendon; the foot being bandaged in a state of extension, in order to keep the edges of the divided tendon in close contact, and to prevent the patient from walking until the union of the tendon was complete. The consequence was, that on obtaining permission to walk

he found the elevation of the heel and the state of the deformity the same as they were before division of the tendon. Had permission to walk been granted immediately on the healing of the skin, whilst the lymph which united the divided tendon was soft and susceptible of extension, it is probable that the operation performed by the patient would have been successful. As the elevation of the heel was not very great, the weight of the body being thrown upon the tarsus would have sufficed to force the os calcis to the ground, and the act of walking might have induced a greater range of motion of the ankle. The cicatrix where the operation was performed by Dr. Inglis is distinctly visible, and about an inch in length transversely over the tendon, shewing that the incision was considerable. Dr. Inglis informs me that he cut from without inwards, doubtless through skin, fascia, and tendon. It is fortunate that so extensive a wound healed by adhesion; a suppurating wound of the tendo Achillis, such as accompanied the first and only operation upon the tendo Achillis performed by Delpech, of which an account was published, would have been attended, as was the case treated by that surgeon, with sloughing of the tendon, a wound tedious in healing, and consequently a protracted and imperfect cure.*

* I have lately been consulted by a gentleman having a case of contracted foot under his care, and who informs me that his patient, although ignorant of the practicability of the operation, had often inquired the propriety of dividing the "cord behind his heel," which he believed to be the cause of his lameness. I had, long previously to consulting Dr. Stromeyer, possessed the same idea of the nature of my lameness, and the method of curing it, as that entertained by Dr. Inglis, and had conferred with many of my professional brethren upon the subject; but I cannot lay claim to the boldness which decided the latter gentleman to operate on himself. I had supposed myself the first British surgeon who had performed the operation of dividing the tendo Achillis for the cure of Talipes, and did not anticipate a rival to my claim of priority, more particularly one who could date his pretensions at so early a period. However, considering the result of the attempt, and as Dr. Inglis was not at that time a member, nor even a student, of the medical profession, I may perhaps be excused in the non-admission of my patient's claims to priority.

CASE VI.

TALIPES EQUINUS CONGENITUS.

Slight contracture of the ankle-joint from spasmodic contraction of the muscles of the calf; the limb, although limited in its functions, presenting no positive deformity.—Cured by division of the tendo Achillis.

The following report of the symptoms, treatment, and result of the case is from the gentleman on whom the operation was performed.

"March 10, 1838. F. Cumming, M.D., ætat. 30, of good constitution. In the erect position the right heel reaches the ground so as to rest on it, but with a degree of constraint. When the foot is placed behind the perpendicular line of the trunk, or in any position in which it is necessary that the ankle-joint should be bent in order to maintain the sole of the foot upon the ground, such as ascending an eminence or stair, it is perceived that the rigidity and shortness of the tendo Achillis limit the motion of the foot to a right angle with the leg, and consequently that in the attempt to take these positions the heel rises from the ground. The foot is $2\frac{1}{2}$ lines shorter than the other, and its arch is greater; the tibia is shorter, more slender, and also straighter; the gastrocnemii are very slightly developed. The affection has existed from the earliest infancy, the inconvenience arising from it being associated with the earliest recollections; hence considered congenital, though its slightness at the time of birth caused it to be overlooked. During growth the right leg did not keep pace with the left; the affection consequently became more and more evident, the gastrocnemii having not only ceased to grow after the age of ten years, but apparently diminished in bulk.

Operation.—March 12th, 1838. Being seated on a sofa, with the right leg extended, Mr. A. Hamilton, one of the surgeons of the London Hospital, who assisted, placing the heel on his knee, bent the joint, and rendered the tendon tense and prominent. Dr. Little, after feeling the tendon,

pushed a small narrow scalpel across the leg anterior to the tendon, and cut it across by three gentle sweeps of the knife. The retraction of the muscle was distinctly felt as soon as the division was completed. The pain of the operation was slight, consisting principally of what may be termed a disagreeable sensation, rather than pain. Dr. Little had previously communicated, as the result of his personal experience, that the cutting of the tendon produced an impression somewhat similar to that felt when a cord is held with one end in the hand and the other between the teeth, and in this position cut across. I can testify to the accuracy of this description of the degree of sensibility in the tendon, having experienced exactly the same sensation. The puncture was closed by a piece of plaster and compress of lint, the ankle loosely bandaged upon a pasteboard splint to guard it from motion; the leg was bent, and placed on the outside: no pain or inconvenience was experienced after the operation; it was done in five or six seconds.*

The report on the following day was—Slept as well as if no operation had been performed; no pain at the point of section, and no irritation in the limb; undulatory motions in the muscles of the leg and thigh three or four times during the night (see pp. 42-45); arose at noon, and lay on the sofa during the rest of the day.

2d day. Slept particularly well; no pain, swelling, or irritation of the limb; no febrile excitement; gentle undulation of the muscles has continued.

3d day. In every respect as yesterday. Dr. Little removed all the dressings. The wound in the skin is quite healed; there is a slight tumefaction over the situation of the section. The dressings were re-applied, the foot placed on the foot-board.

4th day. Slept well, no pain or irritation; the quivering motions of the muscles have ceased; general health and appetite unimpaired by the operation. During this day the

* Patient stated, that although the feeling in the tendon was obscure, he was sensible, nevertheless, of the application of the knife at the point of incision.

extension has been gradually increased, so that the foot is now very nearly at a right angle with the tibia. 9 P.M. Patient continues quite easy; when the heel is depressed the whole line of the tendon is rendered tense, shewing that continuity is already restored. Apparatus ordered to be removed at bed-time.

5th day. Passed an excellent night; the foot and leg free from uneasiness and swelling. Stromeyer's apparatus was reapplied, and the foot-piece gradually raised till the foot was at a right angle with the tibia. In the evening it was raised decidedly above the right angle, when the sensation of tension in the divided tendon increased so much as at 9 P.M. to approach to pain; at the same time the inner ankle and foot shewed a tendency to œdema. The bandage was then removed, in order to relieve the pressure which it occasioned.

6th day. The foot-board was retained all night, but slacker than during the previous day; very slight appearance of œdema in the morning; he now walks whilst wearing the foot-board. 11 A.M. Foot-piece of the apparatus raised by one notch of the ratchet-wheel; noon, raised another, so that the joint was bent more than it could be bent by strong pressure before the operation. This degree of elevation of the toes is perfectly well borne by the skin and tissues around the tendon, (which, as the latter is divided, now undergo stretching,) as only a feeling of tension is produced, which does not amount to pain. 10 P.M. The joint has become somewhat tumid and tender, as the increased flexion of the ankle begins to act upon the ligaments; before retiring to rest the joint was relaxed by loosening the apparatus.

7th day. Slept well; wore the foot-board throughout the night, but considerably slackened: tumor of joint less in the morning. On rising, the foot was fixed on the apparatus at the same angle as that at which the stretching was discontinued last night, since which the foot-piece has at intervals been raised by three notches of the ratchet-wheel. The joint now feels tender; the sensation almost amounts

to pain; it also becomes more tumid and reddened, as if it were affected with rheumatic inflammation: the sensation principally extends from the malleolus internus to the heel. 10 P.M. The swelling increased towards night, so that the whole of the apparatus was relaxed, and the leg placed on a pillow on its outer side.

8th day. Slept well; foot-board applied at the same angle as last night, which was endured without complaint, but the foot has become tender and tumid, particularly around and beneath the malleolus internus, which is now, 9 P.M., covered by a slight blush exceeding the size of a half-crown piece.

9th day. Slept well; health continues as good as before the operation; foot perfectly easy in the morning; apparatus applied at the same angle as when removed last night; and as the joint was scarcely uneasy, the foot-piece was elevated by three notches of the ratchet-wheel, and at 1½ P.M. the foot and joint became tumid, the malleolus internus red and painful. 9 P.M. The joint was so painful that the apparatus was relaxed by a few notches, when it became comparatively easy. Evaporating lotion ordered to be applied to the foot."

The reports of the twelve following days mention only alternate relaxation and tightening of the apparatus. On the 16th day, as the sole of the foot was tender, an air-cushion was applied between it and the foot-board, by which relief was obtained.

On 21st day had a temporary indigestion with headach; on the 22d day, however, the report was as follows:—

"To-day Dr. Little removed the apparatus, and desired me to walk without it, and press forward the knee in walking, keeping the joint bent: walked with tolerable ease.

23d day. Have continued to walk in the apartment; the joint now bends fully as far as that of the other leg, though not without uneasiness; this evening the heel is somewhat tender from a new surface coming in contact with the floor.

25th day. Slept well and felt comfortable; walked much in the apartment, at every step pressing the leg firmly to the ground, and frequently resting on the forepart of the foot with all the weight of the body: joint became painful and tumid in the evening.

26th day. Slept tolerably well; health good; have continued to walk and act on the joint as yesterday; the right (the operated) foot can now be bent to a greater angle with the tibia than the left; forced extension of the ligaments and posterior muscles of the leg produces considerable pain.

28th day. Walked out of doors yesterday and to-day, on each occasion about the distance of one mile; have taken care to bend the ankle to the fullest extent whilst walking.

33d day. Have continued to walk out every day since the date of the last report. At present, when the foot is forcibly bent in walking, the tarsus appears to come in contact with the bones of the leg.

40th day. Visited a friend two and a half miles distant on the 19th. Walked five miles at a leisurely pace, but could have gone faster if the ankle had not been continually bent to the utmost, for the purpose of retaining the degree of flexion which had been obtained.

44th day. Can now walk in the room with scarcely any lameness.

49th day. The style of walking improves; is now equable when not fatigued; the joint becomes uneasy after a long walk. The gastrocnemii act in raising the heel.

May 12th, two months after the operation. Departure from London this day. There is at present very little inequality in the gait, except when exercise is continued so long as to produce fatigue. The gait is not quite so elastic as that of an originally sound person, through the heels being placed on the ground with decision and firmness, in order to retain the gastrocnemii completely extended.

July 2d. The new portion of tendon is now strong, and as large as the original tendon; the extent of motion same as on May 12th. The gastrocnemii are as yet very little increased in bulk, but the extent of their motion and

the briskness of their contractions are evidently augmented, having since my return from London walked more than once the distance of ten miles in a day, but not uninterruptedly.—I can now no longer complain of those inconveniences, arising from the former rigidity of the joint, which were experienced on ascending a stair or hill, or on performing any other movement in which the foot ought to be bent; for this is now accomplished nearly as well on the right as on the left side. The slight difference which exists depends on the shortness of the right foot and the unequal power of the right extensor muscles."

Dundee, July 15th, 1838.

Remarks.—In the introduction to this case, it is stated that the contracture was slight, and that no absolute deformity of the foot existed. The perusal of the periodical report of the progress of the cure may perhaps lead to the conclusion, that if this patient had been subjected to inconvenience and pain to the extent recorded, notwithstanding the slight degree of lameness, the individuals whose cases have been detailed must have proportionably suffered. But the inaccuracy of this inference is apparent from a careful perusal of the preceding cases. It may be asserted, that the degree of deformity does not solely determine the difficulty of the case; other circumstances exercise a greater influence on the amount of pain endured by the patient, and the duration of the period within which the cure can be effected. These are, the age and constitution of the individual, the number of years the disease has existed, and the complications of the case, arising from much previous exercise on the limb (page 37).

The condition of the digestive functions of this patient was very indifferent during his stay in London. Previously to dividing the tendo Achillis, I was doubtful of the propriety of performing the operation, but he was urgent for its immediate performance, and having come to London for the express purpose, could not conveniently acquiesce in the delay until the cure of the temporary indisposition under

which he laboured. As this was not of a nature that would endanger the success of the operation, and some deference being due to his opinion as a member of the profession, I consented. The result was, that the previous indisposition, and the remedies administered for its relief, interfered with his capability to endure the pain and irksomeness of wearing the necessary apparatus. It is well known that medical men are occasionally but indifferent patients. From being acquainted with the cause of pathological phenomena, they anticipate, and frequently even exaggerate the sensations and effects of the remedies of which they are the subjects. This was the case with myself, when under the care of Dr. Stromeyer: it was likewise so in the present instance; for whenever pain was produced in the ligaments of the joint by the use of the apparatus, or by walking with the ankle bent to its full degree of flexion, this patient feared that, by continuing the application of the apparatus, inflammation of the ligaments of the joint would ensue, accompanied with some of the usual consequences: hence the persevering exercise of pressure on the limb to stretch the ligaments of the joint was often improperly discontinued at night.

The sensation of pain in the vicinity of parts immediately affected by the operation, and referred by the patient to the divided tendon, arises from the stretching of the skin and inflamed cellular tissue surrounding the tendon. This sensation is in few cases the subject of complaint, and when it exists is seldom of longer duration than one or two days. Whilst the instruments are being worn after the operation has been performed, the principal source of pain arises from the elongation of the contracted ligaments; and, as in T. equinus and T. varus, the deltoid ligament, owing to its thickness, requires the greatest degree of stretching preparatory to complete restoration of the foot, so in that ligament, and in the expansion of its fibres where it is attached to the bones, the greatest amount of pain is suffered. Thus the patient, when asked to define the exact situation of the part in which he is most sensible of pain, points to the malleolus internus; the pain from this extending

downwards, and radiating towards the heel. Some portion of pain is also commonly felt at the front of the ankle-joint, when, after division of the tendo Achillis, there exists much difficulty in bending the joint. This appears to me to depend, in some instances, on the wider part of the superior articulating surface of the astragalus, which is wedge-shaped, being pushed, during the reduction of the foot, into the cavity existing for its reception at the extremity of the tibia and fibula. This cavity having, previously to the period of the commencement of the cure, only admitted the narrow part of the articulating surface of the astragalus, cannot receive the wider part without producing a strain on the ligaments connecting the bones. In the more difficult cases of T. equinus, after the restoration of the foot has advanced to the extent of forming a right angle with the leg, the patient being enabled to tread upon the heel, and in those wherein I have continued the process of bending the joint in order to attain the greatest angle of flexion, I have observed that the patient complains of pain extending upwards from the back of the malleolus externus, and have attributed this occurrence to the stretching of the peronei muscles. Pain induced by these various causes is not always experienced; young persons enjoy a degree of exemption: whilst it exists to a greater extent in adult congenital cases, or in those of long standing.

The removal of the apparatus during the night is a proceeding that can seldom be permitted with safety. It must be remembered, that the necessity of wearing any apparatus for the purpose of bending the foot after division of the tendo Achillis, does not arise from the application of great mechanical power being required to elongate the connecting lymph, or to extend the skin and the cellular tissue behind the ankle-joint. The daily application of very slight pressure with the hand against the sole of the foot, or a trifling exercise of the limb, would suffice to overcome the resistance offered, and to force the heel downwards to the requisite extent. In young persons, the operation often constitutes all that is necessary to overcome the deformity.

But when, subsequent to the division of a tendon—for instance, that of the gastrocnemii—there remain other contracted muscles, the tendons of which it may not be absolutely necessary to divide, the apparatus should be perseveringly worn, both throughout the day and night, in order to produce and continue the elongation of those muscles for a sufficient period to secure the patient against any recurrence of their contraction.

The number of cases of Talipes which have been cured by division of the tendo Achillis after the failure of mechanical means, although skilfully applied and carefully superintended, proves the difficulty of overcoming contraction of the mass of muscular fibres which constitute the muscles of the calf of the leg. But the cases already related afford sufficient evidence that there is no insuperable difficulty in overcoming the contraction of the other muscles implicated, after the removal of the obstacles presented by contraction of the gastrocnemii; although considerable pain accompanies their elongation by mechanical means, compared with that which attends the extension when a larger number of muscles are divided.

When, therefore, a great degree of resistance on the part of the tibialis posticus, the flexor muscles of the toes, and some of the ligaments of the joint, requires to be counteracted by the application of mechanical means, the necessary apparatus must be worn throughout both the day and night. As one of the properties of elastic and contractile tissues is a tendency to return to their shorter state or position on removal of the extending power, a sacrifice of much progress in the restoration of the foot would be made by the improper removal of the apparatus. The constant continuance of a certain degree of extension of the joint is requisite during the night, or the foot must at least be carefully retained at nearly the same angle it reached during the day. The necessary degree of relaxation of the extension exercised by the Stromeyerian foot-board may be procured by raising the spring *h* (fig. 13), which prevents the ratchet-wheel from turning back; the cord *k* may thus be loosened to the

extent of allowing the cog-wheel *d* to revolve backward for the space of one or two notches; or if the instrument, figured p. 34, be employed to effect the necessary elongation of the ligamentous structures in the vicinity of the joint, the pressure of the shoe-part of the apparatus against the sole of the foot may be diminished by turning the screw *l* somewhat in a retrograde direction.

In this manner the whole of the connecting straps of these instruments are sufficiently loosened to enable the patient to sleep, and yet not so as to admit the recontraction of the tissues which have been elongated during the day. The history of the subjects of the preceding cases previously to being entrusted to my care, proves the great tendency of muscles elongated by means of mechanical instruments to re-contract after the discontinuance of their application. I have treated many cases in which the patients had been several times pronounced cured during the early period of life, although the deformity eventually recurred in an equal or even a greater degree. I am aware that there are exceptions; but they have arisen from particular circumstances. From experience of the comparative facility with which I have cured particular instances of congenital and non-congenital contractures of the ankle without the performance of an operation, I am induced to believe that, in the majority of cases of permanent cure effected by the sole action of mechanical means, when the distortion originally depended on spasm, the mechanist was chiefly enabled to effect the cure by the cessation of the cause of the spasmodic affection which resided in the nervous system, and that the degree of structural shortening of the muscles was comparatively slight.

In some instances, where considerable irksomeness or pain arises from wearing the extension-apparatus, the patient may with propriety be relieved for the night by the removal of the apparatus and the application of a strong tin splint. The foot may thus be secured at nearly the same angle of flexion as it possessed before the removal of the extension-apparatus; so that if no progress be made

during the night, the advantage gained during the day over the muscles which were not divided at the operation may be at least maintained.

I have generally compared the pain and tumefaction of the joint which occasionally occurs, in severe cases of deformity, during the extension of the ligaments of the joint, to those produced by rheumatism. The comparison is just with respect to the nature of the pain, and also with reference to the nature of the particular tissue from which the pain results; but the hyperæmia or congested state of the joint accompanying the cure of Talipes, is very different from the peculiar inflammation of rheumatism; inasmuch as the pain and swelling invariably subside after the expiration of one or two hours subsequent to the removal of the extension-apparatus. However frequent may be the removal and re-application of the apparatus, this cessation of pain and tumefaction invariably takes place immediately. I have also observed in persons whom I have cured, that after complete recovery from these deformities, although of an age at which there exists the greatest predisposition to rheumatism and gout, they do not during atmospherical vicissitudes suffer from pains in the joint which had been affected. This is a circumstance worthy of notice, because in extreme cases of Talipes the joint may have required the application of very considerable mechanical power to replace the bones, accompanied with great straining of the ligaments prior to their elongation.

On considering, before undergoing the operation on my own foot, the extension to which the ligaments of the ankle would necessarily be subjected, in order to reduce the foot to its proper position, I feared, though without cause, that the ankle would be left in a state similar to that occasionally existing in joints which have been accidentally dislocated, —particularly susceptible for a length of time of every change in the wind and temperature, or of any trifling derangement of the digestive organs. An opinion that a joint cured of club-foot in its worse form was afterwards rendered weak or liable to greater susceptibility from this

cause, might deter many from having recourse to the operation of dividing tendons for its cure; but experience shews that all such anticipations are erroneous.

CASE VII.

TALIPES EQUINUS ACQUISITUS.

Non-congenital club-foot of the right side, arising from spasmodic contraction of the extensor muscles of the foot. Cured by division of the tendo Achillis, the tendon of the flexor longus pollicis, and the extensor proprius pollicis.

June 1st, 1838. Mr. ***, aged 33, gives the following history of his case, written by his mother:—"From birth until the time of weaning, which took place at the age of twelve months, he was very healthy, after which he suffered greatly from *weak bowels*. The period of teething was passed favourably. At about the age of four years, whilst at play with other children, some injury was sustained in the right foot, but nothing was discovered amiss on examination by the family medical attendant. In the course of some months, the foot gradually turned inwards. ** recommended the application of an 'iron,' in order to support the ankle, which was considered weak; but its use was not attended with any beneficial results." The patient adds, "About twenty years since, on my arrival in London, I consulted ***, who confessed his inability to do any thing for me, and recommended my parents to place me under the care of ****, who had an instrument made for the foot, by which, and the application of plasters, much pain was occasioned, but to little purpose; I believe I may say to none. About nine years since I applied to *****, who simply recommended a thick heel to be added to my shoe."

The following is the present state of the foot.* It

* It will be needless hereafter to enumerate the whole of the symptoms of every case; I shall merely describe those peculiar to each.

exhibits the whole of the symptoms of T. equinus (p. 3), the heel being elevated to a greater extent than that represented in fig. 1. The toes, particularly the great toe, are in a state of more complete extension, as the skin which covers the extremities of the metatarsal bones is the only part touching the ground, the plantar surfaces of the toes being distant at least an inch. This separation of the toes from the ground partly depends on the state of extension in which they are held by their extensor muscles, and partly on the thick cushion of adipose tissue formed beneath the ball of the foot at the part on which the patient treads.

The toe inclines inwardly in walking, although not to the extent represented in fig. 19; but an examination of the sole of the foot shews that the patient treads equally upon the inferior extremity of the first and fifth metatarsal bones, as both these parts are covered with dense corns. The concavity of the inner margin and of the sole of the foot is very great, depending on contraction of the flexor muscles of the toes and those of the sole of the foot;* the tendon of the flexor longus pollicis muscles and the edge of the plantar fascia can be prominently felt in the sole. On the dorsum of the foot, extending to the great toe, the tendon of the extensor proprius pollicis, and those of the extensor muscles of the smaller toes, are likewise perceived to be very prominent. The great concavity of the internal margin of the foot, the extended state of the first phalanx of the great toe, and the flexed state of its second phalanx, render the foot much shorter than the sound one.

June 6th, 1838. Divided the tendo Achillis with a small common scalpel. The puncture healed within forty-eight hours, and on the third day Stromeyer's apparatus was applied. The descent of the heel gradually took place, but not without the occurrence of periodical pain about the inner ankle, when the degree of pressure exercised by the apparatus

* These symptoms can be seen in fig. 16, as they continued to a diminished extent after the heel had descended to the ground through division of the tendo Achillis.

against the front part of the sole of the foot was increased. The patient occasionally complained of the tenderness of the corns which had for many years invested the parts corresponding to the anterior extremities of the first, third, and fifth metatarsal bones. An air-cushion was consequently applied, to distribute the pressure of the foot-board equally over the entire sole, which afforded considerable relief, and enabled the necessary extension of the remaining contracted parts to be proceeded with without difficulty. The eagerness of this patient to advance the complete restoration of the position of the foot, regardless of pain, was so great, that I was frequently obliged to request him to relax his exertions to obtain the desired end, and to take less exercise in the apartment. Another apparatus, consisting of a shoe-piece resembling the corresponding part of the instrument represented fig. 14, having two iron stems to be applied to each side of the leg, with screws to bend the ankle-joint, similar to that represented at *l* in the same figure, was occasionally substituted, with the view of varying to a certain extent the parts of the foot and ankle against which the pressure was exercised. Some swelling of the ankle-joint, with a little ecchymosis beneath the malleolus internus, occurred at the expiration of the second week after the operation, when the heel not only touched the ground, but the toes formed an acute angle with the leg. The swelling subsided through the application of spirit lotion, but was partially reproduced on the succeeding days, whenever the apparatus was applied with a greater degree than usual of the extending power; however, it invariably subsided on a temporary discontinuance of the extension. At the expiration of the third week, the heel had descended to its natural degree, and the foot, when removed from the apparatus, could be bent beyond a right angle; but in consequence of the unnatural convexity of the tarsus, the toes and front part of the foot could not be pushed so far upwards as the proper extent of flexion of the ankle. During the ensuing week the patient took exercise in the apartment, wearing a common

shoe. The act of walking was at first performed slowly, owing to the continuance of tenderness of the ankle, and particularly of the front part of the articulation. The patient performed his part in the cure with the greatest eagerness: he walked assiduously, although in pain, and endeavoured not merely to retain the extent of flexion already acquired, but was

Fig. 16. shews the appearance of the foot of this patient when standing erect, four weeks after the division of the tendo Achillis. The degree of the extension of the first phalanx of the great toe and the unnatural arch of the tarsus had been much greater before the operation. The dotted arrows indicate the angle formed by the os calcis and first metatarsal bone, from which it will be seen that with reference to the tibia, the posterior tuberosity of the os calcis had descended as low as in the full extent of natural flexion of the foot. It is evident from this fact, that to enable the patient to bend the foot to its full extent, it was necessary that the fore part of the foot, the metatarsus and toes, should ascend, by the foot yielding at the summit of the tarsal arch, the junction of the metatarsus with the tarsus, or between the first and second rows of the bones of the tarsus. The figure likewise shews that a large part of the inner side of the sole did not touch the ground, owing to the increased arch of the tarsus; and it is worthy of remark,

anxious to effect a still further improvement. During the fourth week, the apparatus was partially discontinued, the patient being merely desired to apply Stromeyer's foot-board half an hour daily on first rising, and during that time freely to exercise the limb. By this proceeding the degree of retraction of the divided muscle, and of contraction in the organised lymph connecting the severed ends of the tendon, were regularly overcome before the patient commenced his ordinary pursuits. During the remainder of the day, he wore a common shoe, in which he walked well, but slowly, placing the heel and entire sole evenly to the ground, and bending the ankle-joint in the same manner as a sound person in the act of walking.

At the expiration of the fifth week he walked sufficiently well to enable him to take exercise in the open air, and encounter the jostling of a London thoroughfare. But he still suffered pain from pressure on the corn investing the ball of the great toe, arising from the contracted flexor longus pollicis muscle, aided by the peronei muscles, drawing the ball of the great toe firmly to the ground, as described in the "Remarks" on Cases I. and IV.

The persistence of this symptom, together with the continued extension of the great toe, notwithstanding that the elevation of the heel and consequent deformity had been removed by the division of the tendo Achillis (see fig. 16), occasioned me some regret that I had not divided the tendons of the extensor proprius pollicis and flexor longus pollicis at the same time as the tendo Achillis, the probable necessity of which I had mentioned to my patient on under-

from throwing light on the causes of the deformity and the means of remedying it, that it was requisite, in order to obtain the full bending of the foot, that the great toe should be elevated more than the second toe, the second more than the third, and so on with the third and fourth. It was evident from this circumstance that some cause acted more particularly on the great toe in drawing it downwards and backwards; this cause was the contraction of its flexor muscles. It must be borne in mind, on viewing this figure, that the drawing was taken whilst the patient stood erect; and that the foot could, in other positions, be bent more than is here represented, although not to its fullest natural extent.

taking the treatment of the case. But the arch of the foot having been much flattened by the pressure exercised against the sole in order to bend the ankle, I thought proper to postpone the performance of any further operation for a few weeks, with the hope that exercise might render it unnecessary, by elongation of the flexor longus pollicis and peronei muscles, and the consequent additional flattening of the foot. A similar anticipation had been realised in several cases (as in Case I.), particularly in one patient, thirty-nine years of age (Case V.), whose tendo Achillis I had divided; although in these instances the inconvenience arising from the anterior extremity of the first metatarsal bone being unequally pressed to the ground had not been so painfully experienced.

The age of the subject of the present case, considered in connexion with the extent of the arch of the inner margin of the foot, produced by the contraction of the flexor longus pollicis muscle, and the firmness of the whole of the tissues, rendered it doubtful whether the necessary elongation of this muscle and the ligaments connecting the tarsal and metatarsal bones would ensue by the stretching effect of walking, limited, as this would be, by the tenderness experienced at the ball of the great toe preventing his sustaining the entire weight of the body on the limb.

The patient walked extremely well at the expiration of two months after the operation, and made daily excursions of four or five miles, but still complained of pain from the corn, and occasionally in front of the ankle-joint. He was unceasing in his efforts to ameliorate the condition of his foot; and effectually guarded against contraction of the medium uniting the severed ends of the tendon, by embracing every opportunity of bending his ankle to its fullest extent, and by using Stromeyer's foot-board as a metre of his progress, and a means of instantly detecting the occurrence of the slightest diminution of the power of bending the ankle. He quitted London at this period, and was absent for a few weeks. On his return, he informed me of the great impression the cure of the deformity had produced amongst his

family and friends; but stated that he had been prevented taking as much exercise both on foot and on horseback* as he could have desired, partly through a cold having led to the recurrence of hooping-cough, from which he had been but recently relieved when the division of the tendo Achillis was performed, and partly in consequence of the tenderness of the ball of the great toe. He was therefore urgent that I should now divide whatever tendons I thought could relieve this tenderness, and the deformity arising from the continued extension of the great toe.

Oct. 19th, 1838. Divided the tendon of the flexor longus pollicis muscle in the sole of the foot, and that of the extensor proprius pollicis where it passes over the articulation of the first bone of the great toe with its corresponding metatarsal bone. The division of the flexor longus pollicis was attended with a distinct snap, felt and heard by the patient, the assistant who held the foot, and also by myself. The tendon of the extensor proprius pollicis did not evince such retraction, as the pressure and friction exercised by the shoe for so many years on the tendon had produced inflammation, by which it had become thickened and adherent to the tissues beneath. After the operation, the patient was only able to exert the most feeble voluntary power of moving the great toe, which depended on its receiving a slip of tendon from the extensor communis digitorum, and from the action of the flexor brevis and other muscles of the great toe situated in the sole of the foot.

A single drop of blood escaped from the punctures; a compress of lint was bandaged over them, and the patient desired to keep the foot perfectly quiet. On the third day the punctures were completely cicatrised, when he was desired to walk freely and firmly, and also to endeavour to

* Persons affected with Talipes are usually prevented from riding with comfort owing to their inability properly to retain the point of the foot in the stirrup, which, allowing the foot to slip through it, encircles the ankle, and becomes a source of embarrassment. After the cure of the deformity this difficulty of course ceases.

assist in diminishing the arch of the inner margin by manipulations of the front of the foot, and by standing so as to throw on it the entire weight of the body. When walking, he suffered neither pain nor inconvenience in the situation of either puncture; and in the course of a few days I had the satisfaction to perceive that considerable improvement had ensued; the arch of the tarsus had yielded, so that instead of the metatarsal bone of the great toe resting on the ground only by its anterior extremity, in a direction less slanting than the natural one, I observed that it formed a more obtuse angle with the os calcis, and that a part of its under surface was applied to the ground. This had the effect of completely removing, in walking, the pressure from the painful corn at the base of the great toe, and would have been a sufficient remuneration for the trifling pain endured by the patient under the operation. But the deformity resulting from the contracted state of the great toe was also relieved. Its plantar surface was now applied to the ground, and the front of the foot, instead of presenting the truncated form peculiar to Talipes (figs. 15 and 16), more nearly resembled the pointed appearance of a sound foot.

The boot which he had worn prior to the second operation was now an inch and a half too short; so great was the elongation of the foot consequent on the diminution of the tarsal arch by division of the flexor longus pollicis, and the straightening of the great toe by division of the extensor prop. pollicis.

The report Nov. 10th was,—"He daily walks with ease four miles to his counting-house, in order to exercise the limb, besides occupying himself with business, which requires much additional walking."

Dec. 1st. His gait is at present unaccompanied with the slightest appearance of lameness. He has recently measured the calf of his leg, and is gratified at finding its circumference at least an inch and a half greater than previously to the operation. I have compared this admeasurement with that which I made on his first application, and find that the amendment in this respect is quite as considerable as he

has stated. He can exert volition in every muscle of the leg, and perform the various movements of flexion, extension, abduction, and adduction. A most minute examination of the feet in the act of walking cannot detect which foot had been affected. His cure is indeed perfect.

Remarks.—In this instance, the indications of cure were the same as in the cases already related; it might have been anticipated that their execution would have been more difficult, by reason of the deformity having existed for nearly thirty years, and the various textures constituting and surrounding the ankle-joint having been exceedingly dense and unyielding. Although the gastrocnemii were the only muscles which I believed to have been spasmodically affected, it was certain that the remaining muscles situated on the posterior aspect of the leg must have undergone considerable structural shortening, having, from the deformed position of the foot, been contracted for so many years. Considering, however, that amongst the various patients on whose feet I had previously operated with success, one in particular, aged 28 (see Case XII.), had suffered from an equally great elevation of the heel, and that another had attained the age of 39 years without any insuperable obstacle to bending the joint having been met with, I determined to commence the treatment of this case by dividing the tendo Achillis only. I apprehended that, after bending the ankle to a right angle with the leg, considerable difficulty would be experienced in further bending the foot, through the degree of resistance offered by the deeper-seated muscles on the back of the leg, and the time required to elongate them. I expected that no secondary deformity (such as an imperfect T. valgus) would remain after the operation, as the tension of the peronei would be counteracted by the resistance of the posterior tibial, aided by the anterior tibial, in preventing the outer margin of the foot being raised from the ground, as occurred in Case IV.; but I had anticipated that much inconvenience would be felt from the inferior extremity of the metatarsal bone of the great toe being forcibly drawn to the

ground, as in Cases I. and III. The subjects of those cases were young; and it might reasonably have been expected, that, after division of the tendo Achillis, the weight of the body being thrown on the tarsus, the flexors of the great toe would have been elongated, and the arch of the foot flattened; by which the inferior extremity of the metatarsal bone of the great toe would have been more obliquely applied to the ground, the surface enlarged which came in contact with it, and the tender skin covering the part exposed to a less degree of pressure. In those cases my anticipation had been fully realised; but in this patient, aged 33, the muscles and ligaments of the sole being extremely unyielding, and the ossification of the bones of the tarsus complete, the whole of the ligamentous tissues appearing, if possible, even more dense than in the most robust man,—as if nature had sought to compensate for his treading unnaturally upon the point of the foot by strengthening and consolidating the component parts of its arch,—it became more doubtful whether division of the tendon of the long flexor of the great toe might not be indispensable.

Although the result of this case has been so highly satisfactory, the division of only three tendons having been necessary, I am inclined to the opinion that much pain would be spared in similar instances of adult Talipes equinus by division of the posterior tibial and the peronei tendons, although these muscles may not have been in the first instance spasmodically affected (p. 88). This opinion is opposed to the rule (generally applicable) which I would lay down for the guidance of the surgeon, not to divide more tendons than those of the contracted muscles which may have produced the deformity (see Remarks appended to Case II.) But future experience must determine the propriety of this proceeding. Although much suffering would be avoided in the extension succeeding the operation, by dividing the peronei or posterior tibial tendons in adult cases of Talipes equinus, it might be objected that the ankle-joint would be laterally weakened, through which, after the replacement of the whole of the superior articulating surface

of the astragalus in the tibio-fibular cavity, a tendency of the astragalus to yield outwardly or inwardly, according to circumstances, would exist, and the patient's step be proportionably less secure. This objection pre-supposes that the security of an articulation depends on the strength and activity of the muscles surrounding it, as well as on the form of the bones entering into its composition, and that section of the tendons of the peronei and posterior tibial muscles would be followed by permanent weakness of these muscles, and an inability to afford a due degree of lateral support to the joint. The justice of the first supposition is not only proved by observation of the circumstances attending dislocations of many of the joints of the body, but particularly by the secondary phenomena of club-foot; for soon after spasm or paralysis of one or more muscles of the leg occurs, we find that the degree of support afforded to the bones of the foot by the strong ligaments which connect them is insufficient to prevent deformity ensuing, through the disturbance of the equilibrium of the muscles, or through pressure against the earth by the weight of the trunk being thrown upon the bony structure in improper directions.

As to the second supposition, experience proves that, if the operation and subsequent treatment be properly conducted, the tendo Achillis reunites after division very firmly, and by a bond of union as large or larger than the original tendon. The ends of a divided tendo Achillis present a large surface for the interposition and consolidation of the adhesive medium; and therefore it is reasonable to believe that smaller tendons unite by a proportionally strong and secure intermedium. As in a large number of contracted feet of adults, whether the origin may have been spasm or paralysis, the whole of the muscles have undergone material primary or secondary injury as respects their innervation, the foot must be viewed as a passive rather than as an active organ of locomotion; and amidst the various points to be attended to, the main object is to cure the deformity, and enable the patient to use the limb with

comfort and activity. Unless, therefore, the division of the tendon of a contracted muscle will weaken the articulation in a direction which is undesirable, owing to the nature of the distortion and accidental form of the articular surfaces, and it cannot be readily elongated by mechanical means, its division should be accomplished, if practicable, according to the principles of Stromeyer already laid down.

The following I consider as the most simple and safe mode of dividing the tendon of the flexor longus, or of the extensor proprius pollicis. I pass a short narrow-bladed knife, the end of which is rounded, through the integuments parallel to the tendon, in that situation where (in cases requiring its division) it is felt tense and prominent; then, with one surface applied to it, glide it underneath, and having carried the end beyond the tendon, turn the handle of the knife so as to bring the edge against the tendon, by which it is readily cut through, without any enlargement of the puncture in the integuments (see page 31). In dividing the extensor proprius pollicis, I introduce the knife on the inner side of the tendon.

It is requisite to allude to the supposed origin of the lameness in the present case. It is stated by the patient's parent to have been an injury sustained whilst at play: it is certain, nevertheless, that the deformity had not for its cause an origin of that kind, but arose from some disturbance of the nervous system, most probably acting along the chain which induces the *reflex functions*, and not depending upon actual disease of either of the central organs of the nervous system, the brain or spinal cord. I have no doubt, from the history of this and many similar cases, that the contraction of the muscles of the calf came on insidiously, and did not attract the attention of the parent until some trifling accident at play, as a fall, (induced probably by the gastrocnemii being even at that time partially affected with spasm, and imperfectly under the control of the child,) led to an examination of the limb; after which time the increase of the contraction and deformity were anxiously watched. Had the attack of spasm of the gas-

trocnemii been complete on the onset, it might have depended either on some *sudden* derangement of an organ, involving a peripheral part of the nervous system (as a respiratory or chylopoietic organ), or on some disease of its central parts, and would probably have been immediately preceded or accompanied by some obvious indisposition. But as the contraction unquestionably was gradual, it is more probable that the remote cause was some *chronic* derangement of an organ affecting a peripheral part of the nervous system; and I believe that we have the solution of the problem in the early history of the patient. He is stated to have suffered from "weak bowels," which signifies probably a tendency to diarrhœa or other symptoms of gastric or intestinal morbid sensibility.* There is, in my opinion, no cause more frequently productive of these and similar spasmodic contractions of particular muscles, than derangement of the mucous membrane of the alimentary canal, whether it arise from the irritation of worms and improper food, or consist of chronic inflammation.† The disturbance may continue a considerable time unheeded, or without suspicion of its tendency to induce secondary disease being awakened. By means of the chain of filaments on which the reflex functions of the nervous system depend, it may be inobtrusively exciting involuntary contraction, evinced by a scarcely perceptible limp, a tendency to fall, or a certain wayward action in walking. At this period it frequently happens that, if the foot of the child be examined when not actually engaged in walking or standing, no anormal condition can be perceived (unless, perchance, there be already a slight diminution of the bulk of the limb); for Dr. Stromeyer has shewn, and I have had numerous opportunities of verifying his observation, that it is characteristic

* See the clear and elaborate definition of morbid sensibility and irritation in "First Principles of Medicine," by A. Billing, M.D., third edition, 1838.

† Imperfect nutrition, whether it result secondarily from disease in any organ of the body, or be the direct consequence of deficiency of food, is one of the most active predisposing causes of these deformities, as of all neuroses.

of the affection of the gastrocnemii (previously to its acquiring the highest grade, and having existed a considerable period when atrophy commences, see pages 7, 55,) to be excited into activity, or much increased, when the sole of the foot touches the ground as in walking. This will remind the reader of the effects of irritating or touching the web of the frog's foot, or the skin of the sole of the rabbit, when the excitability of the muscles is augmented by narcotism or decapitation, or the influence of volition removed. The membrane and skin covering those parts are, like the skin of the human sole under certain circumstances of disease (Talipes), more particularly susceptible of external impressions, and when irritated capable of producing reflex muscular contractions.

It is in this early stage of the production of Talipes and analogous distortions that the curative efforts of the physician are most successful.

CASE VIII.

TALIPES VARUS CONGENITUS CONVERTED INTO T. EQUINUS BY INSTRUMENTS.

Congenital right club-foot, from tonic spasm of the muscles on the back of the leg. Cured by division of the tendo Achillis and the tendon of the tibialis posticus muscle.

Master **, aged 12, a slender youth, but in good health, was born with a deformity of the right foot, consisting of an elevation of the heel and a twisting inwards of the toes. The parents state that ever since birth no expense has been spared in obtaining the first medical advice. It was recommended that the child should be placed under the care of a mechanist of high repute, whose attendance continued several years. Trifling progress, however, being made towards the restoration of the foot, other mechanists were successively consulted; and the use of the apparatus recommended by

each as the means by which a cure would certainly be effected was diligently persevered with until the present time.

The condition of the foot at birth appears, from the relation of the parents, to have corresponded with that represented fig. 3. The little positive improvement which has since taken place can be properly estimated by an examination of fig. 17, which exhibits the present state of the deformity.

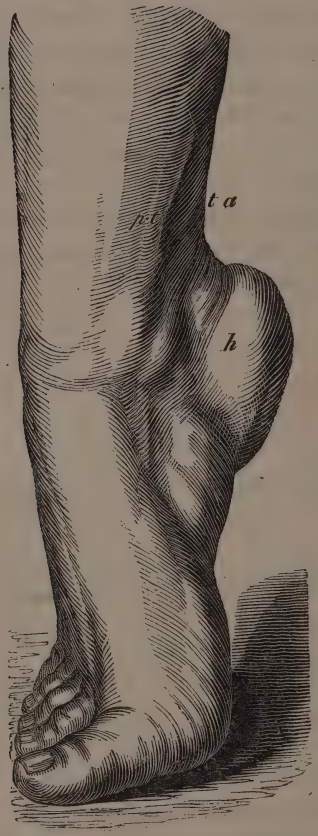


Fig. 17. — *Congenital Talipes varus converted into T. equinus by instruments, in a youth aged* 12. The letters *t a* represent the tendo Achillis; *p t* the tendon of the posterior tibial muscle; *h* the heel elevated to the utmost from the ground.

The heel is elevated to the fullest extent, and cannot be

drawn down by the hand; the toes are inclined somewhat inwards, and there is a slight convexity of the tarsus externally. The patient still wears an apparatus, contrived with the view of preventing the foot from twisting further inwards, and of forcing the heel downward; but which is quite inadequate to the accomplishment of the second intention, even if in this case it were practicable without an operation. The foot when supported in the apparatus, or as seen without it when the patient is erect, the weight of the body not being thrown on the limb, is, as represented in the figure, nearly in a straight line with the leg; but when, as in the act of walking without any apparatus, a considerable part of the weight of the body is borne by the limb, the tarsal and ankle joints yield in such a manner that the foot turns inwards, and presents the appearance of severe Talipes varus. The patient treads only on the anterior part of the sole corresponding to the anterior extremities of the metatarsal bones, which, owing to the extent of the elevation of the heel, are in a perfectly continuous line with the leg. The foot can be bent a little upwards; but its progress in this direction is arrested at a very obtuse angle with the leg (the heel remaining four inches from the ground), by the resistance of the tendo Achillis and other muscles on the back of the leg. During the attempt to bend the foot, the tendo Achillis and the tendon of the tibialis posticus muscle are rendered very tense and prominent, the latter being visible in consequence of the emaciation of the limb. The imperfect development of the bones of the leg, the wasting of the muscles, and the diminution of the temperature, are the same as in similar cases already described. The foot being held in the state of extreme extension by the contracted muscles, it follows that no voluntary motion can take place in that direction; but the patient is able to abduct and slightly bend it, which shews that paralysis of the peronei or anterior tibial muscles does not exist: moreover, when he endeavours to bend or abduct it, the contraction of these muscles may be felt with the hand. The remaining symptoms and the gait of the patient are perfectly characteristic of this advanced grade of T. equinus.

Jan. 2d, 1838. Divided the tendo Achillis and tendon of the posterior tibial muscle in the manner described pages 30 and 31, assisted by Mr. Armstrong of Islington, who attended the case subsequently in conjunction with me; Mr. Andrews, senior surgeon of the London Hospital, being also present. The pulsation of the posterior tibial artery was felt in the vicinity of the tendon. The retraction of the divided tendons was observed by these gentlemen as well as myself. A single drop of blood escaped from each puncture. The common dressing was applied, and the limb laid upon a splint. Two days afterwards, both punctures having united by adhesion, Stromeyer's foot-board was applied loosely, in order not to exercise more than slight extension, and to avoid pain at first. The extension proceeded favourably, so that in a few days the instrument represented fig. 14 was substituted for the foot-board, through which he was better enabled to take exercise in the apartment. Before the expiration of a month, the ankle was bent almost to the full extent of flexion. This gradual transformation of the foot into a natural shape was at times attended with considerable pain and restlessness, particularly at night, through which it became necessary to loosen the straps of the apparatus. He was allowed the ordinary diet; his health continued good, except an occasional indigestion and headach, caused by the confinement within doors, which was rendered necessary by the inclemency of the weather. Extension was discontinued previously to the expiration of the fifth week; the prolonged wearing of the instrument represented fig. 14 being recommended, for the purpose of overcoming the slight inward curvature of the tarsus and metatarsus which remained.

Feb. 3d, 1838. Patient has returned into the country; a boot, resembling that worn by the subjects of Case II. for a short period after the operation, being recommended for out-door exercise. He treads evenly on the entire sole, and has acquired an entirely new manner of walking, so that the appearance of only the most trifling lameness remains.

After the following Easter he returned to school, which

was situated upwards of a mile from his home; and as it was necessary to walk thither morning and afternoon, his regular exercise was upwards of five miles daily, in addition to the distance traversed during the amusements followed by boys of his age. He could accomplish this without any of the exertion, fatigue, and attendant perspiration, which were always occasioned previously to the performance of the operation.

Oct. 1st. 1838. I have seen my patient to-day: he walks extremely well. The inward curvature of the foot has nearly disappeared, through constant exercise on it in a proper position. He can raise the foot by the action of the anterior muscles of the leg; those of the calf are increasing in bulk, although not very rapidly; but the youth of the patient, and the pride which he evinces to walk well, are the best guarantees that further development of the powers of the limb will ensue.

Remarks.—I have described (pages 3, 4, 13) T. equinus to consist of an unnatural *extension* of the foot on the leg; whereas in T. varus there is an addition of *adduction* and of *rotation*, analogous to supination of the hand. The patient was born with the latter affection, but the unremitted application of mechanical apparatus during the whole of his life had removed the adduction and rotation of the foot, leaving the extension; thus diminishing or merely transforming the distortion into Talipes equinus, which existed when he was placed under my care. The previous treatment had, in the opinion of the parents, effected much, by removing part of the unsightly appearance of the foot; but it had accomplished little towards converting the limb into a state of activity and usefulness.

Those who, unacquainted with the operation of dividing tendons, have published the result of their experience in treating these distortions by the use of mechanical instruments, have generally stated that they succeeded with comparative facility in overcoming the twisting inwards of the foot—the adduction and rotation; but that the main dif-

ficulty in the treatment consisted in overcoming the "shortness" of the tendo Achillis, and bringing the heel to the ground. They confessed their inability, in a large number of cases, to overcome the resistance which the contraction of the gastrocnemii muscles offers to the replacement of the foot; and thus their most unceasing exertions for a number of years had no better result than the leaving a T. equinus in the place of T. varus. The more respectable of the mechanists who have had long experience in the treatment of these affections, and with whom I have conversed on the subject, have made the same admission to me. But of still greater value are the facts related concerning a large number of the patients whose cases are here published. Even those whose circumstances had not merely admitted of purchasing an instrument constructed for the cure of the deformity, but had enabled them to avail themselves of the regular attendance of the mechanist (in some instances daily) for months and years, —had experienced that degree of relief only which accrues from the transformation of T. varus into T. equinus; and some under this expensive and tedious treatment had not obtained even that benefit. How little improvement, therefore, should we anticipate in the cases of those whose means permitted only the occasional purchase of some instrument comparatively useless, but vaunted, nevertheless, as certain to effect a cure.

Although in this patient the adduction and rotation of the foot had been cured,—by which should be understood that the contraction of the muscles which formerly retained the foot constantly twisted inwards had been overcome, so that the foot was no longer jerked inwards the instant the apparatus was removed,—yet it possessed a great tendency to return to its original state. The movement of adduction and rotation peculiar to T. varus is permitted by means of the natural arrangement of the bones of the tarsus. The yielding in the tarsus, through which the foot assumes the form of those represented figures 5, 9, and 11, does not solely result from the looseness of the ankle-joint which exists when the heel is elevated by the contracted gastrocnemii—causing the

narrowest part of the superior articulating surface of the astragalus to be situated within the widest part of the cavity at the inferior extremity of the tibia and fibula,—but takes place chiefly at the articulation of the first with the second row of tarsal bones—at the articulation of the astragalus and os calcis with the navicular and cuboid bones (see fig. 8). The result of the existence of the adduction and rotation of the foot during the earlier years of life is, that the development of the osseous parts situated on the *inner* side of the ankle (those compressed in consequence of the vicious position of the foot) is interfered with, and they become smaller than natural; while the protecting eminences lose part of their prominence, and are rounded off, so that should the foot be reducible to T. equinus, a tendency to relapse, occasioned by this weakness of the inside of the tarsus, remains. The parts which thus suffer in their development are, the round head of the astragalus, the navicular bone, and the internal malleolus. The circumstances in which the *outer* surface of the parts composing the articulation between the first and second row of tarsal bones is placed, present no obstacle to the perfect proportional development with the entire limb (which I have elsewhere stated to be inferior to that of a sound one, see pages 6 and 7); on the contrary, the edges of the bones interested, the outer surface of the round head of the astragalus, and the external surface of the ossa calcis and cuboides, near to the part where they are applied to each other, not only attain their proportional development, but also frequently become incrusted with osseous deposit, occasioned by the friction and pressure of the shoe or instrument; or, as in the worst forms of the disease, by coming against the earth in walking. The comparative deficiency of the internal malleolus and parts on the inner side of the tarsus, occasioned by the compression early exercised by the various parts against each other, and the subsequent constant struggle of the adductor muscles of the foot to draw the foot inwards, cause a considerable degree of permanent mobility, in the majority of cases, between the first and second row of the tarsal bones. This mobility allows of the point

of the foot going freely inwards; whereas the complete proportional development of the edges of the bones on the external surface of the tarsus will not permit the foot to be moved externally beyond the point at which it may have been retained, or to which it may have been forced, by the application of instruments. There exists a hinge at this part, which allows the fore part of the foot to turn inwards, but stops its motion outwards beyond a certain point.

However great the amendment of the appearance of the foot may be, through the removal of the turning inwards of the foot by the application of mechanical instruments, little has been effected towards the conversion of the limb to a state of usefulness, unless the contraction of the gastrocnemii and consequent extension of the foot have been completely removed, so as to enable the heel and the entire sole to be placed fairly upon the ground; and for this the division of the contracted tendons is, in cases like the present, absolutely necessary.

The accuracy of the opinion given previously to the operation, concerning the absence of paralysis, is confirmed by the condition of the anterior muscles described in the last report.

The "Remarks" appended to Case VII. render necessary here a few observations relative to the motives which induced me to divide the tendon of the posterior tibial muscle in this case. The condition of the foot when the patient was first placed under my care was that of Talipes equinus. The spasmodic form of this distortion does not depend on spasmodic contraction of the adductor muscles of the foot (pages 22, 53), and consequently division of the posterior tibial tendon is not always necessary. But there are cases of T. equinus of very long standing, where a considerable degree of *structural* shortening exists (page 101), in which it may be advisable to divide the posterior tibial tendon, in order to accelerate the attainment of a cure, and diminish the pain of the mechanical extension.

The subject of Case VIII was young; and consequently, had the case been one of simple T. equinus, there would

have been no difficulty experienced in elongating the posterior tibial muscle by mechanical means. But the case was congenital, and had originally been T. varus. The retention of the foot in the position of T. equinus represented in the figure, was accompanied by considerable resistance on the part of the posterior tibial muscle, its tension being not only evident to the touch, but also to the sight, dependent on permanent spasmodic contraction of that muscle. It is true that the shortening of its fibres had been partially overcome by the persevering use, for several years, of mechanical apparatus; and I was confident that, on division of the tendo Achillis, this muscle could not ultimately prevent the bending of the foot, and that the patient would thus be enabled to place the heel to the ground; yet, considering the existing tendency of the foot to relapse into T. varus, and thinking there was a probability that, even after the bending of the foot was accomplished, the contraction of the muscle would occasion the patient to tread unequally on the sole of the foot—more on the outer than on the inner edge—and walk with an inward inclination of the toes, I was satisfied of the necessity of dividing its tendon in conjunction with the tendo Achillis.

CASE IX.

TALIPES EQUINUS CONGENITUS.

Talipes equinus congenitus, combined with bending of the knee and an imperfection in the motions of the hip, affecting the right extremity. Similar affection on the left side, but in a slight degree. Congenital inward squinting of the right eye. Origin — disturbance of the development and functions of the central organs of the nervous system during fœtal existence; consequent spasmodic contraction of the gastrocnemii, semi-membranosus, semi-tendinosus, biceps femoris, (probably also of the psoas and iliacus internus) muscles, and rectus internus of the right eye. Treatment of the T. equinus by division of the tendo Achillis; the cure of the bending of the knee being effected by the same operation, and subsequent mechanical extension.

Aug. 23, 1838. Miss ***, aged 21, is stated by her mother to have been born at the period of seven months of utero-gestation, with a contracture of the right leg, which has resisted all the means hitherto adopted for its cure; namely, baths, frictions, attempts at straightening with the hands, and the application of various mechanical contrivances.

On examination, the limb appears perfectly formed in every part, the muscles being well developed in comparison with the average number of congenital distortions. *On attempting to stand erect,* the patient touches the ground with only the front part of the right foot, the heel being elevated two and a half to three inches, and the right knee bent to an angle of forty degrees. The sole of the left foot is placed perfectly flat on the ground; but the corresponding knee is bent to the same extent as the right. Both thighs appear slightly flexed. This seems, at first view of the case, simply the result of the knees being bent, as the trunk of the body cannot possibly be held erect whilst the knees are bent, unless the thighs be proportionably flexed. This inference is just with reference to the left side, as the patient can, when desired, move the left thigh in every proper direction; but she has not the same extent of voluntary influence over the right hip. When standing on the left leg,

and directed to carry the right thigh as far backward as she is able, it is remarked that she cannot extend it beyond the perpendicular line of the trunk, which is a limited degree of motion compared with that proper to the hip of a sound person. There exists, therefore, a certain degree of involuntary contraction of one or more of the flexors of the thigh (the psoas and iliacus internus muscles); and it is probable that the exercise of volition over this hip is further embarrassed by the unequivocal spasmodic contraction of the flexors of the knee (the semi-membranosus, semi-tendinosus and biceps muscles). *In the recumbent posture*, the left extremity is throughout entirely straight, the hip and knee joints admitting of free motion in the proper directions; but the foot cannot be bent to a greater extent than a right angle with the leg. The right extremity continues contracted in the sitting and erect postures. Pressure by the application of one hand against the anterior part of the sole of the foot and the other hand on the knee, does not enable me to overcome the contraction (see page 8); but pressure on the knee only effects a slight straightening of this joint, although at the same time it produces a proportionate increase in the elevation of the heel; and *vice versâ*, pressure applied against the sole of the foot only, has for its result a slight bending of the ankle, accompanied with a proportionate increase in the bending of the knee. The extent of the lameness and deformity induced by the contraction of so large a number of muscles implicated in this case, can be conceived by a person attempting to walk with the knee and hip joints bent to a considerable extent, the heel of the left foot touching the ground, but with that of the right foot constantly elevated.

She had been recommended to wear a heel two inches high on the right boot, which enables her to support the body on each limb alternately; and in order to accommodate the articulations of the left extremity to those of the right, and render the act of walking more equable, she has subsequently resorted to a similar heel for the left foot. This is the only plan which has ever afforded the least relief; but

notwithstanding, exercise requires great exertion: she is unable to walk a mile without great fatigue, and that distance even has to be accomplished with the assistance of sticks, or the arms of attendants.

Sir A. Cooper, and my friend Mr. Norwood, of Hertford, having agreed with me on the nature of the case and the necessary plan of cure, I divided the right tendo Achillis Aug. 28th, 1838, with a small ordinary scalpel; and on Sept. 1st, the puncture having healed, Stromeyer's foot-board was applied.

The process of extension was accompanied with but comparatively little pain; and within a fortnight the ankle was bent to the proper extent without difficulty. This result was attributable to the absence of any deformity of the bones composing the ankle-joint. The knee had also become nearly straight, simply through the daily application of a trifling degree of pressure by the hands to the front of the joint.

On the fifteenth day after the operation, the foot-board of Stromeyer was removed, and another apparatus substituted. This was adapted, by means of screws, to endeavour to effect the complete straightening of the knee. It had a foot-piece attached, similar to the foot-part of the apparatus represented fig. 14, for the purpose of retaining the ankle in its newly acquired position.

The application of this instrument was continued during the ensuing four weeks, in consequence of the difficulty experienced in overcoming the slight but rigid contraction of the biceps femoris, semi-membranosus, and semi-tendinosus muscles. Their resistance to the complete straightening of the knee was so considerable that, notwithstanding the constant attention devoted to the patient for the purpose of increasing the power of the instrument whenever it became necessary, there was an alteration in the position of the knee of a very few degrees. Great pain was also experienced during this period.

The major part of the bending of the knee having been accomplished simply by the division of the tendo Achillis,

the T. equinus completely removed, and the ankle retained several weeks in its bent position, and exercise now being requisite to obtain a due degree of mobility of this joint, the discontinuance of further extension of the knee was directed. An instrument (similar to that worn by patients who, after fracture of the patella, are unable to straighten the knee), adapted by means of springs to retain the knee in a straight position, although constructed so as to permit of its being bent at will, was recommended to be worn day and night.

The patient continued to take regular exercise, and at the expiration of six weeks after the discontinuance of the process of extension, walked daily three or four miles.

Dec. 1. The degree of bending of the right ankle is the same as six weeks since, and equalling that of a sound foot —not the slightest return of the deformity having ensued during the consolidation of the lymph which unites the divided tendon; the right knee is still somewhat bent, although to a very trifling extent. The patient has had neither tenderness nor pain in the ankle or knee for many weeks. She still walks with an awkward gait, somewhat resembling her former manner, although, having experienced so much improvement in her sensations, being able to stand firmly for any length of time, and to walk a considerable distance without fatigue, she is scarcely sensible of the remaining degree of lameness. On observing her manner of standing and executing the necessary movements of progression, I find that both knees are still bent very considerably, although the left knee can be perfectly straightened when in the sitting posture, and the right knee nearly so. It is therefore evident, that immediately the weight of the body has to be supported, the anterior muscles of the thigh—the extensors of the leg—are unequal to their office; being overcome by the flexors of the leg, the biceps femoris, semi-membranosus, and semi-tendinosus muscles, the contraction of which is increased during the erect position of the body. The bent state of the left knee is likewise augmented by the tension of the gastrocnemii. With the view of counteracting the contraction of the whole of these muscles, and of even elongating, if pos-

sible, the gastrocnemii, I have recommended that an instrument be worn on the left knee, similar to that previously recommended for the right. Should it not elongate the gastrocnemii, it will at least have the effect of assisting the extensor muscles of the leg to enable the patient to walk uprightly, giving to those muscles the opportunity of gradually contracting, and probably of obtaining increased power.

Dec. 8th. My patient is now wearing both the knee-instruments; they completely answer the purpose intended; she walks much better. They admit of bending the knees on being seated, and do not prevent her rising easily; but by assisting those muscles which are under the control of the will in keeping the knees straight, they cause her to walk with a certain stiffness, as when a sound person attempts to walk with the knees straight. By supporting her when erect, they indirectly add one or two inches to her height, and have caused the disappearance of all positive lameness.

Remarks.—This case is interesting by illustrating the concurrent congenital affection of numerous muscles of the body (pp. 25, 66). It is unnecessary here to speculate at length on the remote causes of the distortion; but there can be little doubt that the proximate cause consisted in a derangement of the nervous system of the fœtus, whether produced by some cause acting entirely within the fœtus, and inducing a morbid state of its vascular and nervous systems, or dependent on disturbance of the health of the parent. The mother of this patient mentioned having during gestation suffered extremely from the movements of the fœtus in utero, an event which had not occurred in her previous or subsequent pregnancies. Other parents have mentioned the same circumstance, which would favour the supposition that the fœtus had been the subject of violent convulsions, and that a permanent affection of some portion only of the nervous system remained as part of the more general affection. Turbulent movements of the fœtus are events of every-day occurrence, whereas these distortions are comparatively unfrequent: additional evidence of the connexion between these two events is consequently

requisite before we can admit their relation as cause and effect. The subject of this case is stated to have been born at the seventh month of utero-gestation; the phenomena attending both fœtus and parent which precede parturition when so early effected, may therefore have exerted a powerful influence in producing the injury of the nervous system on which the distortion depended; for as the individual bones of the leg and foot were not deformed, but in every sense perfectly developed, and the muscles and other tissues less wasted than is often the case in Talipes, it may be inferred that the injury did not occur until a short period anterior to birth. A circumstance corroborative of this opinion is, that although the parent and the accoucheur who attended are positive respecting the existence of the deformity of the right ankle at birth, they express some doubts concerning the contracted state of the knees and left ankle. It is therefore probable, that the too-early transition from the fœtal existence to an independent state, at the period when the stomach and lungs were incompetent to prepare healthy chyle and blood for the support of the frame, and the nervous system was too little developed to enable the system advantageously to struggle with external agents, may have been the cause of additional injury to the spinal cord or appendages, evinced by the gradual occurrence of contraction of the affected muscles of the thighs and left leg. The absence of atrophy, either of the bones or soft parts, may have depended on the vegetative portion of the nervous system having remained unaffected during the primary disturbance of the nervous system.

The brain, or that portion of it which presides over the intellectual functions, had not suffered during the existence of the derangement of the nervous system which produced the deformity, as the mind was acute, and capable of the highest development; differing in this respect from that of another young lady in whose case I have recently been consulted, affected with a similar distortion, and in which considerable weakness of intellect exists. The latter, as I was assured by the parent and attendant practitioner, was like-

wise born at a very early period of gestation — anterior to the completion of seven months.

The prognosis was favourable with reference to the Talipes equinus, as there could be no doubt that by division of the tendo Achillis the patient would be enabled to place the heel and entire sole to the ground, and obtain the full extent of natural motion. The circumstance likewise of any attempt to bend the ankle increasing the bending of the knee, informed me that, in addition to the contraction of the flexor muscles of the leg, the shortness of the gastrocnemii contributed to maintain that deformity, and therefore that division of the tendo Achillis would relieve as much of it as depended on this cause. Although aware, from experience, of the difficulty of elongating muscles spasmodically contracted by the application of mechanical instruments, I expected that mechanical extension would suffice to overcome the slight bending I had anticipated would remain; thinking it probable that no greater degree of the bending of the right knee had arisen from the contraction of the flexors of the leg than that which existed on the left side. Being occasionally disposed to think that the tendency to contraction in both knees might have been aggravated by the long wearing of the high-heeled boots, and as contraction of muscles produced by long-continued repose in a certain position is most amenable to mechanical treatment, I was encouraged to entertain the hope that its cure would be proportionably facilitated.

The progress of the cure justified the greater part of my anticipations; the report of the case proves that no difficulty was experienced in remedying the T. equinus, or in extending the right knee to within a few degrees of a straight line, through division of the tendo Achillis; but the attempt perfectly to straighten the knee by the application of mechanical power occasioned a tenfold amount of pain, and the expenditure of greater time and attention than had been requisite to obtain the previous great results; affording another convincing proof of the incomparable facility and superiority of the method of treating contractures by division

of tendons to that by simple mechanical extension. It might be inquired why, knowing the difficulty of stretching muscular fibre, I did not in this case divide the hamstrings in the right limb, if not in both. This operation would greatly have facilitated the reduction of the limbs to their natural form; but the contraction depending on the flexor muscles of the leg constituted the smaller part of the deformity; and I did not consider it advisable to perform the operation, although so necessary and successful in contractures of the knee to a greater extent.

Congenital contractures of more than one joint, and affecting both extremities, are on the whole difficult to treat; and unless a thorough investigation be instituted of all the attending circumstances, and a skilful prognosis made, disappointment may ensue both to the patient and practitioner. I would advise the latter to avoid over-rating the benefits likely to be obtained, and to state distinctly and forcibly the precise nature of the alteration that can be effected in the patient's condition. If, as in this case, there be no choice of methods, then let the patient and friends understand that the sole prospect of improvement depends on the performance of the operation.

In investigating a case of congenital or non-congenital deformity, and determining the propriety of an operation for its relief, the practitioner should recollect that he has to remedy an affection the inconveniences of which are usually threefold,—the actual deformity of the part affected; the pain and fatigue accompanying progression, or perhaps even the total inability to walk; and the degree of lameness or awkwardness of gait and carriage, visible on every movement. Most persons, particularly the young, are extremely sensitive on the subject of personal deformity, and consequently are as anxious for the removal of the first and third of the inconveniences enumerated as they are to be relieved from pain and fatigue, especially if their circumstances enable them to avail themselves of carriage or horse exercise. Those more advanced in years, who may have become indifferent to the opinion of others respecting their personal

appearance, and have discarded the feeling of shame whenever they are directly or indirectly reminded of their deformity, and others who depend for their livelihood on the ability to walk with ease and activity, are equally or perhaps more directly interested in the second series of inconveniences I have recapitulated. The cure of these distortions is most successful in relieving the actual deformity of the part, and in enabling the individual to walk without the pain and toil which, previously to the operation, commonly attends locomotion; whereas, however striking may afterwards be the amendment of the gait of the individual, there often remains, especially after Talipes varus, some trace of the former lameness. This arises either from a want of the elasticity characteristic of the gait when the influence of volition in the muscles of the calf is properly exercised, or from the adductor or rotator muscles of the thigh being imperfectly under control, and causing a peculiar swinging movement of the entire extremity; or from a continuance of part of the associated actions which the muscles of the trunk and upper extremities had assumed during the existence of the deformity, through the laborious efforts required when walking.

The deductions sometimes required to be made from the attainment of absolute perfection in walking after the cure of club-foot and analogous distortions, are trifles in comparison with the extraordinary benefits which this operation is capable of conferring under careful management; and to them I request the attention of the profession, that the over-zealous in diffusing the practice of dividing tendons may not, by promising too much, attract to the Stromeyerian method a share of the odium which is generally attached to all new remedies and plans of treatment when abused during their introduction to general use.

CASE X.

DEFORMITY OF THE ANKLE RESEMBLING IN EXTERNAL CHARACTERS TALIPES EQUINUS.

FALSE ANKYLOSIS OF THE ANKLE IN THE EXTENDED POSITION,

Shortening of the gastrocnemii and other posterior muscles of the leg, induced by the cicatrisation of extensive abscesses, which had extended in various directions among the muscles on the posterior part of the leg, accompanied by caries of the bones, particularly of the tibia. Cured by division of the tendo Achillis.

Sept. 4, 1837. Miss ****, aged 27, informs me that when about seven years of age she was attacked with a scrofulous disease in her right leg, accompanied with numerous abscesses, ulcerations, and fistulæ, the last of which closed twelve years since. During the continuance of this protracted disease she was unable to walk: on its subsiding, the extended position assumed by the foot for so long a period had produced a permanent elevation of the heel to its greatest extent. This position had arisen from the anterior muscles of the leg being overbalanced, in the absence of the exercise of volition, by the superior power of the gastrocnemii and other posterior muscles, combined with the gradual contraction of the numerous cicatrices. The patient now walks upon that part of the sole of the foot corresponding to the metatarso-digital articulations (as in fig. 2), which is covered with the usual painful corn investing the cutis when subjected to undue friction or pressure. The heel is drawn upwards by the contracted muscles of the calf to the extent of five inches; this distance is retained even when the entire weight of the body is thrown upon the affected limb, or when the patient endeavours to force it down; so rigid, indeed, is the contraction, that no efforts of mine to force up the toes effect the least alteration in the form of the foot. There is no actual deformity of the foot beyond the fixed state of so-called extension, and a greater convexity of the arch of the foot than is natural. The whole of the muscles of the affected thigh and front of the leg are weaker than those

of the opposite side; those of the back and outside of the leg are bound down to the bones by about ten or twelve large indented cicatrices, some of which exceed the length of three inches. She is incapable of exercising any voluntary power by the action of the anterior muscles, through their being constantly kept on the stretch; and is also unable to exercise the posterior muscles, some of them in various parts being firmly adherent to the bones, and the remainder being already contracted to their fullest extent. The entire extremity, owing to the fixed straight position of the foot, is rendered longer than that of the opposite side. The tibia and fibula, however, from the long continuance of the scrofulous disease, not having kept pace in growth with those of the opposite limb, are about one inch shorter, and consequently diminish to that extent the excess in length of the affected extremity. This, in addition to the studious efforts of the patient to conceal her deformity, by walking leisurely, and as much as possible upon the toes of the sound leg, renders the lameness less than that which usually results from a contracture so considerable as that represented in fig. 2. She cannot stand or walk for any great length of time, particularly if the pavement be sloping or uneven, without considerable pain and fatigue. She is urgent for the performance of an operation, which has succeeded in the case of an acquaintance, also one of my patients, whose deformity was of twenty-five years' standing. The non-existence of any true anchylosis of the joint is evident from the lateral motion given to the astragalus and tarsus by alternately moving the toes inwards and outwards.

Sept. 7. Divided the tendo Achillis, using a small straight French bistoury. I passed the knife through the skin on the inner side of the limb, opposite to the part where the tendon was least engaged by the adhesions, and as far from the anterior surface of the tendon as compatible with the safety of the posterior tibial nerve and vessels, one side of the knife being directed towards the latter. The edge was then directed backwards against the tendon, the point being made to describe a quarter or third of a circle, the centre

being that part of the skin where the external puncture was made. By this cutting backwards and circular motion of the point of the knife, the tendo Achillis, and nearly all the adhesions (which I found to be fibro-cartilaginous) between the edge of the knife and the skin, were divided in the same manner I usually adopt for cutting the former only, without puncturing the skin of the opposite side of the leg. After the withdrawal of the knife, two small portions of fascia, or bands of adhesions, were felt through the integuments unsevered, which were cut by the reintroduction of the bistoury. The wound, a quarter of an inch in length, was dressed by adhesive plaster, and the limb laid on its outer side, supported by a pasteboard splint, moulded to the form of the foot. Cicatrisation immediately followed.

On the sixth day Stromeyer's foot-board was applied, without attempting extension of the remaining resisting tissues of the back of the leg, viz. the tibialis posticus, musculi flexores, and the ligaments of the joint, as I judged it prudent, notwithstanding that the part was completely healed, to proceed more gradually than after an ordinary section of the tendo Achillis, in order to allow the lymph effused between the divided ends of the tendon and in the track of the knife through the old cicatrices, to acquire a more complete organisation, and thus prevent the probability of exciting any degeneration of the reparatory process, or inflammation.

After a few days, the cord of the apparatus was slowly tightened, but with very little amendment in the state of the ankle-joint. The patient complained of restless nights, and took a few doses of tinct. opii. The pain endured from the apparatus was not referred to the situation of the ligamentum deltoideum and fibulare posticum, to the former of which, after the operation for club-foot, patients usually point as the part where they feel the process of extension; she principally complained of an acute pain at the back of the fibula, about two inches above the malleolus. On the eighth day of the extension I found, to my disappointment, that the foot was nearly in the same position as before the operation, the

heel having but slightly descended; it was therefore evident that some unusual impediment existed to the bending of the ankle. At the place where she complained of pain and of having felt the process of extension, close to the tendons of the peronei muscles, there was a cicatrix adherent to the bone, and somewhat inflamed, appearing as if it had been on the stretch. I now suspected that these tendons might be implicated in the cicatrix, and adherent to the fibula, although before the operation I believed them to be free; I therefore resolved that if, on subsequent examination, this suspicion were confirmed, I would divide them below the cicatrix. The bandages and apparatus were removed, and the spirit lotion directed to be constantly applied to the ankle; and a dose of laxative medicine to be taken, in order to accelerate the removal of œdema of the parts, which obstructed an accurate examination.

On the eighteenth day after the division of the tendo Achillis, all swelling having subsided, I was enabled to satisfy myself of the precise state of the parts. There was no adhesion of the peronei tendons at the cicatrix, for on moving the ankle-joint as far as the deformity would admit, I found that they were rendered, both above and below the cicatrix, alternately tense and lax. The cicatrix was still slightly œdematous and red, accompanied with a sensation of pain on attempting to press the toes upwards, ranging from the cicatrix to the posterior extremity of the os calcis. By careful manipulation I discovered what I believed to be a firm band, passing from the os calcis, or from the inferior portion of the divided tendo Achillis, to this cicatrix of the fibula. Pain was felt in the direction of this band on pressure, and also on endeavouring to force the toes upwards.

My friend, Mr. Herring of Sun Street, who attended the case with me, coincided in the opinion that this fibrous band constituted the impediment to bending the joint; I therefore determined to divide it between the cicatrix and its connexion with the lower part of the tendon, which was effected after the manner of dividing a tendo

Achillis, with the exception of the introduction of the knife on the outside of the limb. The wound at the part healed the second day, but a minute puncture, made by the curved point of the knife in the posterior median line, cicatrised a day or two later. Stromeyer's foot-board was then immediately re-applied, and the same degree of extension which had previously produced great pain and uneasiness was now borne with comparative ease. The heel gradually descended, and on October 9th, fourteen days after the second operation, she was able to put the heel and entire sole to the ground, which had not been done for twenty years. A lighter modification of the apparatus was subsequently worn for three weeks, to support the joint when walking, and (although the foot had now acquired to the eye of a cursory observer a perfectly natural form) to endeavour to bend the ankle beyond a right angle with the leg, and thus obtain the full extent of natural motion. The wearing of this instrument did not occasion the slightest uneasiness; on the contrary, it proved a source of ease, for when the foot was allowed to hang unsupported, she felt, as is usually the case for a short time after the operation, pain from motion of the recently elongated ligaments of the joint. This inability to retain the foot in a bent position by the action of the anterior muscles of the leg, was caused by their previous elongation during the many years the deformity had existed.

Nov. 5. All apparatus is laid aside, and the patient now walks with a common shoe; her gait resembles that of a person who has recently recovered from a sprained ankle or broken leg, placing the foot cautiously on the ground, and turning the toes outwards, to avoid motion of the yet tender ligaments of the joint. She only complains of the sensation that her leg is much shorter than it was previously to the operation, or than the other leg is at present. It was stated at the commencement of this report, that the tibia and fibula were nearly an inch shorter than those of the opposite extremity; but her impression is, that when walking the operated limb is at least three or four inches shorter than

the other. This impression arises from a false sensation, depending upon its former greatly elongated state. The spinal column and pelvis, with the vertebral and pelvic muscles, had accommodated themselves to the unnatural length of the deformed limb; and the ankle-joint being now restored to its proper action, and the limb shortened to the extent of the former elevation of the heel (five inches), it is not surprising that the change should appear to the patient so remarkable. It may be observed, notwithstanding that the foot is cured, and that for three weeks she has been walking on the whole of the sole, the shoulder of the affected side continues higher than the other; so tardily do the pelvis and vertebral column right themselves after having been compelled during so many years to assume an unnatural position. This will shortly subside, and the only remaining trace of lameness will depend upon the difference between the actual length of the tibiæ.

Nov. 19. The stiffness and awkwardness of the gait have much decreased. A perceptible difference exists in the length of the two extremities, although the exaggerated sensation of shortening has ceased. The shoulder which had previously been elevated has gradually descended, and is somewhat lower than the other. She is able to stand or walk within doors for a considerable part of the day, without experiencing uneasiness, with the exception of a slight pain over the front of the articulation when she throws the whole weight of the body upon the toes in ascending the stairs. I have this day carefully examined the state of the muscles of the leg: the situation where the tendon was divided is not indicated by depression or enlargement; she can voluntarily contract the gastrocnemii, and, assisted by the other posterior muscles, draw up the heel; the action of the peronei in drawing the toes outwards is perfect; and she can also, by means of the tibialis anticus and other anterior muscles, bend the ankle-joint perfectly.

Jan. 1, 1838. At the present time she is able to walk or dance as if the limb had never been contracted.

Remarks.—The *indications of cure* in this case, as in contractures from other causes, were to divide the tendo Achillis, and to obtain, by gradual stretching with the appropriate apparatus, the full natural extent of motion of the ankle-joint. A difficulty presented itself, arising from the lowest cicatrix—uniting the skin, bones, and tendo Achillis—approaching closely to the insertion of the latter into the os calcis; and also from the distance between the anterior surface of the tendon and the back of the ankle-joint (occupied in a healthy limb by yielding cellular tissue) appearing, from thickening and induration around the tendon, to be filled up by a dense mass of organised lymph, which denoted the former situation of an abscess. It was necessary to avoid injuring the bursa at the insertion of the tendo Achillis, and appeared objectionable to traverse the old cicatrices in the course of the operation. But being convinced that the greater portion of the obstacles to bending the joint would be overcome by division of the large and inelastic tendo Achillis, with as much of the subjacent indurated cellular tissue as might be reached with safety to the tibial nerve and vessels (unless that left undivided were completely fibro-cartilaginous), I did not hesitate to undertake the treatment of this case on the same principles by which I am guided in the congenital or non-congenital T. equinus.

In this case, the prompt recovery of the power of volition in the tibialis anticus is highly instructive in the study of the ætiology of congenital Talipes equinus, and, indeed, of club-foot in general.

In the commencement of my investigations into the causes of these diseases, I supposed, in common with those who had previously entertained the subject, that the debility of the anterior muscles of the leg invariably resulted solely from the long-continued over-action of the powerful antagonist muscles, producing mechanical extension, and physically altering the muscular fibres. That the latter takes place to a certain extent is proved by this case, as the patient was for more than a month after the removal of the deformity unable to bend the ankle; but we find that although the

anterior tibial muscle had been held mechanically stretched to the utmost possible extent for nearly twenty years, a few weeks nevertheless sufficed for the complete recovery of its power, on the restoration of the ankle-joint to its proper motion; whereas, in Talipes of paralytic origin, where the same muscle was primarily involved, and which I have watched for three years after cure by division of the tendo Achillis, I have not perceived that the paralysed muscle recovered any portion of its natural power, although this only caused a trifling impediment in walking.

CASE XI.

DEFORMITY OF THE ANKLE, RESEMBLING CLUB-FOOT IN EXTERNAL CHARACTERS.

FALSE ANKYLOSIS OF THE ANKLE IN THE EXTENDED POSITION.

Contraction of the gastrocnemii, and other so-called extensors, from abscesses in the back of the leg, and necrosis at different parts of the tibia and fibula, principally of the latter bone. Cured by division of the tendo Achillis.

July 27, 1837. Miss ***, ætat. 24, the daughter of a medical friend, informs me that a disease attacked her right leg nearly nine years since, which at first was supposed to arise from rheumatic inflammation. It continued for four years, during which period numerous abscesses were formed in different parts of the back and outer side of the leg, from several of which large pieces of bone were removed. When the wounds had entirely healed, and she had regained strength, she found herself unable to touch the ground with more than the front part of the foot (see fig. 18), the heel having been drawn up to the extent of two inches and a half. The action of walking was consequently very difficult. This has throughout continued, great fatigue and profuse perspiration resulting from any trifling exercise. Her medical attendant had placed her under the care of a mechanist of repute, who undertook, by means of appropriate apparatus, to

overcome the contraction of the calf, and gradually to force the toes upwards and the heel downwards. This plan had

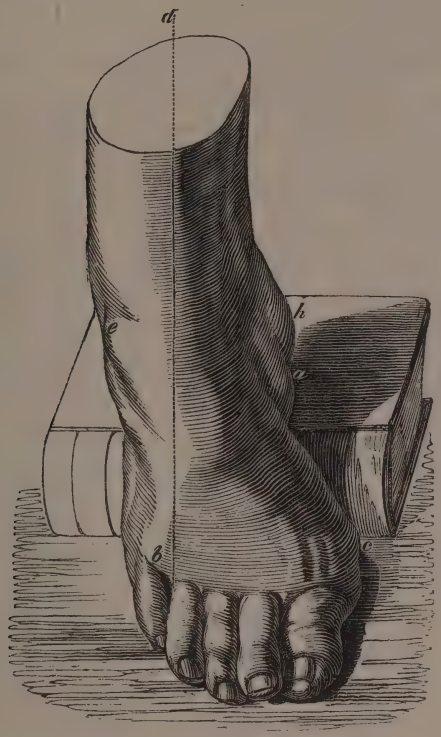


Fig. 18. *Spurious Talipes varus*, Case XI. The letter *a* indicates the prominent belly of the abductor pollicis muscle, rendered visible by the approximation of the anterior extremity of the metatarsal bone of the great toe *c* towards the heel *h*. One result of this approximation is, that the foot is considerably shortened, although rendered broader, as in the case of true Talipes. The perpendicular line *d b*, passing through the axis of the leg, shews the inward inclination of the anterior part of the foot, the little toe being alone situated on the outside of that line. The patient therefore chiefly walked on the ball of the little toe.

been since perseveringly continued to the present time by the almost daily attendance of the mechanist, without the production of further benefit than the prevention of any aggravation of the contracture.

The patient does not touch the ground equally with the

ball of the great and little toes, but chiefly treads on the latter, from the toes having been thrust inwards, giving to the foot the appearance of Talipes varus. This is particularly shewn in fig. 18. There also exists a degree of external convexity and internal concavity of the tarsus, a shortening of the distance from the posterior extremity of the heel to the metatarsal articulation of the great toe, and a projection (see *a*, fig. 18) occasioned by the outline of the abductor pollicis muscle, all characteristic of the similar grade of Talipes varus.

August 1st. Divided the tendo Achillis, assisted by my friend Mr. Kingdon. The recoil of the severed ends of the tendon was distinctly felt and heard. The puncture was dressed with a strip of adhesive plaster, and the limb, loosely bandaged, laid in the deformed position upon a common pasteboard splint.

Second day after the operation. The dressing was removed, the puncture having united by adhesion. On examining the limb, I felt a small string, or bridle, remaining undivided at the part where the tendon had been cut. This, as it was situated on the inside of the tendo Achillis, may have been the plantaris tendon, or a strip of fascia, or a small band of old adhesions. I divided it by a minute puncture, and after dressing the limb, placed it upon Stromeyer's foot-board, without exercising any extension.

4th day. The cord of the apparatus has been tightened for the first time, in order to produce some extension of the muscles and ligaments which continue contracted.

7th day. The extension has been slowly carried on, without pain or inconvenience to the patient, except from the pressure of the apparatus against one of the corns covering that part of the sole on which she formerly trod. A friend of the patient this morning undertook to remove the projecting part of the corn which occasioned the pain, in doing which he unfortunately wounded the cutis. This trifling accident has occurred very inopportunely, as the tenderness that may result will interfere with the perseverance in the necessary use of the apparatus.

10th day. The apparatus has been continually worn, but the inflammation around the corn required the application of poultices, and prevented the progress of the extension. The pain is subsiding, and the wound made in cutting the corn has healed. We can now proceed with the extension.

11th day. Patient has complained of pain in that part of the foot covered with the corns; indeed, so greatly did she suffer during the night, that when summoned I was obliged to loosen the apparatus, although it had been by no means tightly applied; the constant pressure, although but slight, having sufficed to re-excite inflammation of the skin surrounding the corns. To produce a more equable distribution of the pressure of the foot-board over the entire sole, I have placed beneath the foot a temporary air-cushion, prepared by introducing portions of the intestine of a bullock within each other, tying them firmly at one end, and properly securing them after inflation. I doubled the intestine to prevent its stretching, whereby it might have become too flaccid, or burst from the pressure. On the application of this contrivance she was totally relieved from the soreness and pain, and could even bear a greater pressure than I considered necessary for the gradual forcing upwards of the toes; in short, she felt more comfortable when wearing the foot-board than without it, the elastic uniform pressure against the entire sole having at once relieved the burning pain of the inflamed skin surrounding the corns.

12th day. The experiment of the introduction of the air-cushion has completely succeeded, but I have substituted for the inflated intestine a properly made caoutchouc air-cushion. The heel has considerably descended; I have directed the patient to walk about the room, to assist its descent by throwing the weight of the body on the foot. Pain in the corns has ceased, but has commenced in the ankle-joint. Spirit lotion to be constantly applied to the ankle.

16th day. The foot-board has caused little inconvenience since last report; I have this day removed it, and allowed the patient to walk across the apartment without any appa-

ratus, the entire sole and heel of the foot now touching the ground. I have, however, advised its reapplication, with the intention of bending the ankle so that the foot may form the proper angle with the leg.

22d day. The foot is now bent to the extent requisite to ensure perfect walking hereafter. I have discontinued the foot-board, and applied a lighter instrument, which combines the perpendicular elastic springs of the Scarpa shoe with a certainty of bending the joint to the natural extent by means of a screw acting as a lever against the spring (fig. 14). The patient can now walk with facility. The only remaining inconvenience arises from tenderness of those ligaments of the joint which have undergone elongation.

It is unnecessary here to offer any further detailed reports from my note-book; I may, however, be permitted to give a summary of the subsequent progress.

Six weeks after the operation, the patient walked with a common shoe, the ankle-joint possessing the natural extent of motion; at the end of two months, when all œdematous swelling had subsided, the union of the tendo Achillis could be felt perfect. She could, by means of the gastrocnemii, tib. post., &c. straighten the foot upon the leg, and freely contract the anterior tibial muscle, thereby raising the foot. The peronei had likewise recovered their power, affording a strong contrast with their inactivity in cases of club-foot resulting from paralysis of those muscles. During the succeeding severe cold weather, she occasionally suffered from pain in the ankle-joint, which for a short time caused a certain degree of lameness. The gait has progressively improved; and I have since learnt from Mr. Kingdon that this lady is able to walk as well as any person who had never been affected with lameness.

The following extract from a communication, dated March 16, 1838, will indicate the progressive improvement:—

"My foot is so delightfully well now, that I am quite anxious to shew it to Sir A. Cooper. I have repeatedly walked five or six miles without the slightest inconvenience;

and I cannot conclude this without once more expressing my gratitude to you for having afforded me so much comfort and ease in walking, to which I was so long a stranger."

Sir A. Cooper had occasionally seen this young lady previously to the performance of the operation: on seeing her afterwards, he was much pleased with the alteration of the foot, and the improvement which had taken place in her general health.

December 6th, 1838. A great amendment in the state of the foot and the muscles of the leg has ensued since the above reports. The patient can not only perform the whole of the ordinary movements of the foot, but stand on the affected leg, throwing the entire weight of the body on it; and whilst in that position, can even elevate the heel and rest on the toes only. This suffices to shew the perfect nature of the union of the tendo Achillis, and the complete recovery of the function of the muscles of the calf. The improvement in the form of the foot consists of a considerable elongation; the great toe extends an inch farther forwards than represented at fig. 18, in consequence of the flattening of the tarsal arch.

Remarks.—I select the opportunity of the publication of this case to offer a few more observations relative to the comparative utility of the mechanical and chirurgico-mechanical treatment of these and similar contractures. Few surgeons will entertain a doubt as to which method is entitled to the preference, after perusing the reports of the cure in a few weeks of adult congenital and non-congenital cases of club-foot by division with the scalpel of the resisting tendons. These cases demonstrate, that the application for many years of mechanical means is too often insufficient for obtaining a partial cure, even when commenced in very early life.

But in the chirurgical method of cure also, difficulties may arise which may threaten a total failure, from an incautious manner of proceeding and want of discriminating the necessities of each particular case. I am not therefore surprised daily to hear the results of cases of the division of

tendons for the cure of contracted limbs by the method of Stromeyer, which reflect but little credit on this great improvement of modern surgery.

The reader should not undervalue the operation from the circumstance of the cases hitherto related not having been of the highest grade of deformity. They better illustrate the superiority of the chirurgico-mechanical treatment over the simply mechanical; for it is obvious that if the latter mode does not succeed in the slighter forms of disease, it has a much less probability of success in the severer cases.

To adduce cases of club-foot cured by this operation, and in which long-continued mechanical treatment is stated to have failed, may by some be regarded as no proof of the absolute necessity of the division of tendons, as the mechanical method often labours under serious disadvantages; such as the patient, frequently of tender age, becoming intractable from uneasiness, if not from positive pain, during the continued wearing of an appropriate apparatus; the parent likewise, although in good circumstances, harassed by the complaints of the child, grows tired of the expense of instruments, and the necessary attendance of the mechanist; and often witnessing but slow amendment, after perseverance for months or years, he at length loses courage, and first discontinues the application of the apparatus at night, and ultimately lays it entirely aside. In the event of the progress being greater, the parent, anxious to see the child walking unencumbered with an iron, prematurely abandons the instrument, and soon has the mortification of witnessing the return of the disease. During this time the medical attendant of the family is rarely consulted, the matter being often considered derogatory to his professional dignity: he thus loses sight of the case, and the parent at length relinquishes *curative* means, satisfied with allowing the child to wear that description of iron which is of the greatest assistance in walking; and thus the deformity is allowed to remain throughout life. Should the parent be poor, the mechanical treatment is most frequently dispensed with altogether.

These are the disadvantages under which the mechanical

treatment labours; they would become objections, even if it could be admitted that the majority of contracted feet were ultimately curable by these means, which they are not.

In the case before us, the patient had been placed under the care of a mechanist of repute on the cessation of the disease of the leg which had been the primary cause of the contracture. His daily manipulations of the joint and continued application of instruments were assisted by a patience and perseverance truly feminine; yet these means failed in effecting any alteration in the form of the foot, the only benefit obtained being the counteraction of the tendency of the toes to twist inwardly, and the prevention of the increase of the contraction, which might otherwise have reached the extent represented in fig. 2, or that described in Case X. It cannot be reasonably objected to the chirurgico-mechanical method, that it is often attended with more uneasiness or irksomeness, or with a greater degree of pain; for even if it were admitted that the certainty of cure under both methods of treatment was ultimately equal, the chirurgico-mechanical mode would still be preferable, from the rapidity of the cures effected by it, and the absence of the disadvantages attendant on the simply mechanical plan. During the cure of contractures, as well as the treatment of most diseases, if a speedy and unequivocal amendment be perceived, neither the parents nor the patients (if able to judge for themselves) are discouraged by the occurrence of pain, nor do they complain of the necessary trouble and perseverance. For the purpose of instituting a further comparison between the respective merits of the different methods, I recently treated a few cases solely by mechanical means, and succeeded in removing the deformity; amongst others, a child of the age of ten months, who was placed under my care by his father, a surgeon, for division of the tendo Achillis. The father was anxious for the performance of the operation, as I had previously by this means cured his eldest son, ætat. 16, whose case had resisted every previous treatment. Except in slight and infantile cases, the time and exertion expended is so great, and the pain and worry to a child so considerable,

that ultimately the operation must, in the great majority of instances, be resorted to; and often, if the deformity be relieved without it, the surgeon cannot promise that the disease will not return, unless the wearing of an instrument be long persevered in.

The resemblance which existed between the deformity in Cases X. and XI. and true Talipes, is interesting and instructive in studying the various causes which produce this and analogous distortions. The fixed state of extension of these feet was induced by circumstances which presented an analogy in one respect with the causes of Talipes, but which in other respects were essentially different. It has been stated (page 23), "that any cause (paralysis, spasm, cicatrices, protracted repose of a limb,) by which the equilibrium between different sets of muscles that are naturally antagonists is disturbed, produces the distortion vulgarly called club-foot." The deformity in these cases had not been produced by the causes which engender true Talipes, viz. paralysis or spasm, but by the combined operation of muscular contraction from long-continued repose of the limb in a certain position, and the contractions of cicatrices. The analogy simply consisted in the contraction of muscular fibre being one cause of the deformity. They were cases which come under the denomination of the "false ankylosis" of writers. Case X. resembled T. equinus, whereas Case XI. partook of the characters of T. varus. It is difficult to assign a cause for this difference between them, as in the former case the elevation of the heel was greater, and had existed a greater number of years, than in the former. It may have arisen from the circumstance of the tarsus and metatarsus being in Case X. completely in a perpendicular line with the leg, through which the foot was better enabled to bear the weight of the body than if, as in Case XI., the elevation of the heel being less, the tarsus and metatarsus forming an angle with the leg, the foot had been weaker, and thus disposed to yield to either side. The inward tendency of the foot results probably from the natural form of the foot admitting of greater extent of adduction than abduction.

The perfect recovery of the influence of volition in all the muscles of the leg, is a fact of the highest importance in establishing the utility of dividing the tendo Achillis for the cure of genuine Talipes. As sometimes in such cases considerable debility and even atrophy of the gastrocnemii remain after the operation, it might be inferred that the division of the tendon was the cause of the weakness; and it has frequently been asked of me whether the same weakness would have remained had the cure been effected by the application of mechanical instruments. This question presupposes the curability of the majority of cases of Talipes by mechanical treatment alone, which I deny; and no direct answer could therefore be given to this question, as it is impossible to assert previously to the occurrence of an event what may be the consequences of it.

As in Talipes, whether spasmodic or paralytic, the function of the contracted muscles is impaired, or its exercise suspended, by reason of the injury in the nervous system which has induced the distortion, we cannot reasonably expect that, by whatever means the shortening of the muscles is removed, the latter can be restored to integrity as respects the supply of nervous energy (when the origin was spasmodic, or the want of antagonists when the origin was paralytic), unless the original disturbance in the nervous system have subsided previously to the treatment of the deformity, and the contraction which remains be simply that from structural shortening.

It is well known that rupture of the tendo Achillis, or accidental division of that or any other tendon, is not necessarily followed by a loss of the function of the muscle, unless the union of the divided part have been interrupted or rendered incomplete by some accidental complication, as absence of proper approximation of the separate ends of the tendon through tight bandages or other improper treatment, the occurrence of suppuration or sloughing of the tendon, its unnatural adhesion to the neighbouring parts during cicatrisation, &c. These are, however, only negative facts in favour of the opinion that division of the tendo Achillis for

the cure of club-foot is not necessarily inimical to the functions of the muscle; but of far greater value is the positive information afforded by the experience of Cases X. and XI., as in them the muscles of the calf, after having been for many years incapable of exercising their function owing to a mechanical obstacle, recovered the greater part of their activity by the removal of that obstacle; and they would in every probability have recovered the whole of the natural power, if their entire development had not suffered some check by their having remained many years at rest, or if the free play of the belly of the muscles had not been limited by adhesion among their fibres, resulting from the former inflammation. But there was not, as in many cases of club-foot, any dynamic cause in operation to prevent the muscle recovering the whole of its functions of voluntary contraction; the supply of nervous energy from its fountain, the spinal cord, remained as copious and as regular as it was before the commencement of the disease in the leg.

In support of this assertion, that the operation of dividing the tendo Achillis does not produce the weakness which occasionally remains afterwards, I have hitherto availed myself of the experience of these two cases; but I may also direct attention to the extent of the power recovered by the muscles of the calf after division of the tendo Achillis in cases of club-foot (vide Cases I., II., V., VII., VIII., IX.). To this I may add, that in patients who have been cured by the Stromeyerian plan, it is seldom possible to distinguish the part where division of the tendon has been effected—so perfect is the generation of new tendon, and the union between the severed extremities. It will not therefore be doubted, that in as far as the simple operation is concerned, the susceptibility to voluntary contraction of the muscular fibre is the same after as previously to the operation; but I have great reason to doubt whether the same could be said of muscular fibres elongated by the application of mechanical instruments, were it even possible to effect sufficient elongation of them to cure the worst cases of club-foot. The stretching of muscular fibres in opposition to the involuntary motor nerves which tend

to keep them contracted, can hardly be effected without ultimately injuring the susceptibility to contraction of the fibres; and indeed it is only through having overcome their contractility by the gradual but long-continued application of force, that we can boast of having effected a cure by mechanical means. It is a treatment at variance with our knowledge of the properties of muscular fibre and with the pathology of the affection, as demonstrated in the preliminary treatise (pages 15-25); and is at best a coarse and unsurgical mode of proceeding, which I may not inaptly compare to the forcing a spasmodic stricture of any of the mucous canals, as the urethra, with the bougie or sound, instead of resorting to the more rational and scientific treatment by opiates and other medicines, abstractions of blood, fomentations, and even division with the knife; and I have noticed that in cases where the mechanical power applied has been insufficient to produce elongation, either in consequence of the age of the patient or extent of the shortening, the rigidity of the contraction has been increased by the stimulus afforded to the quiescent organic contractility, analogous to the effects of ordinary exercise upon healthy muscles. The great tendency which contractions of the gastrocnemii have to recur when they have been overcome by the aid of mechanical instruments, has already been alluded to; and although in slight cases of club-foot I do not think it desirable to subject the patient to an operation not absolutely or urgently requisite, I have had too frequent opportunities of observing in my own practice, and in patients who have been treated by others, how incompletely the gastrocnemii can be elongated by instruments; and that, although the patient may be enabled to place the heel to the ground, it is constantly prone to be elevated in walking, independently of the will, by the spasmodic action of the gastrocnemii. I believe that when this does not take place, the spasmodic cause of the distortion has subsided previously or subsequently to the commencement of the treatment. See page 56, where the persistence of structural shortening after the cessation of the spasmodic contraction is pointed out.

I may with propriety remark, that among the instances of Talipes cured by mechanical means, a large number will be found to have originated in paralysis; for as in them the contraction is the same as that which takes place from protracted repose of a limb, being the result of the slow exercise of the organic contractility of the muscular fibre during the absence of the action of antagonists, it may be overcome with comparatively little difficulty without operation, unless it be attended with considerable structural shortening (see page 54).

CASE XII.

TALIPES EQUINUS ACQUISITUS.

Converted by constant exercise into a deformity resembling in external appearance Talipes varus. Cause, spasmodic contraction of the gastrocnemii. Cured by division of the tendo Achillis.

Dec. 1st, 1837. Mr. ****, aged 28, of remarkably robust habit, and large, well-proportioned frame, affected with lameness of the left foot, gives the following written history of the case.

"When one year old, was strong, active, and healthy, and able to run alone; suffered little from teething. At about the age of three years the contraction was first noticed, the heel not touching the ground in running. He was taken to *, who made light of it, and said, 'Tell the mother to give him plenty to eat and drink, and let him run about without his shoes.' This was done, without any benefit. He was taken next to **, who recommended a particular kind of shoe, which was tried without success. *** was next consulted, who referred the patient to an instrument-maker, whose constant attendance lasted about three years, and considerable improvement ensued; but being eight years of age, he was sent to boarding-school, and the instruments

discontinued. From this time there was no farther improvement; on the contrary, in three or four years the lameness became much worse, accompanied with pain in the ankle and back of the leg. **** recommended a shoe with a high heel, which was disapproved of by *****, who recommended a renewal of the instrument-maker's treatment; and this has been persevered in fruitlessly until the last few years. *****, on being asked to what cause he could attribute the lameness, said the child was of a puny habit; the other physicians and surgeons consulted have said the same thing."

Present condition of the limb :—The foot is permanently extended, the heel being drawn upwards to the extent of five inches by the contracted muscles of the calf. The instep possesses an unnatural convexity, and the sole of the foot indicates a corresponding concavity. The wasting of the limb is not so extensive as is frequently observed in Talipes; the muscles of the calf, although less developed than in the right leg, being as large as those of many persons of slender form. A difference exists between the length and thickness of the leg-bones, but very trifling. The affected limb does not appear colder than the other. The foot is large, but has not the tapering shape of a well-formed foot; the tissues composing it, bones, muscles, tendons, and ligaments, appear more compact and better developed than feet affected with Talipes arising from paralysis. When the patient is seated, and the muscles of the leg are at rest, the foot resembles that represented in fig. 1, the toes and metatarsus being nearly in a straight line with the leg; but in walking, the toes and front part of the foot are thrust inwardly by the outward yielding of the astragalus, so that the inferior extremity of the metatarsal bone of the little toe is placed beneath the perpendicular axis of the tibia, and is compelled to support the entire weight of the body, as in fig. 19. From constant treading on so small a portion of the sole as that constituting the base of the little toe (the surface not exceeding the circumference of a shilling), he suffers great pain from inflammation arising from the friction against the ground. He has also a sensation of

great weakness, caused by the outward tendency of the ankle, and is often in danger of falling suddenly, or "trip-

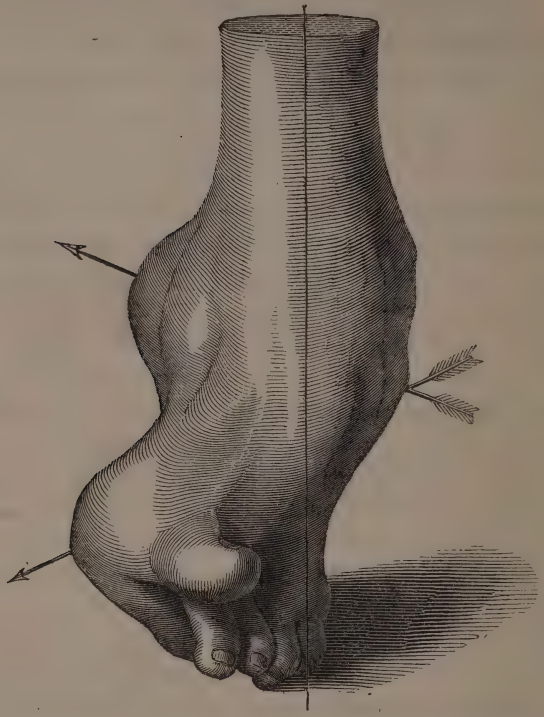


FIG. 19.—*The foot of the subject of Case XII. viewed from the front and somewhat from the inside.* The arrows indicate the direction of the convexity of the tarsus and metatarsus—forwards and outwards; the perpendicular line through the axis of the limb shews the extent of the deviation inwards of the metatarsus, by which the base of the little toe, being brought completely beneath the axis of the limb, has to support the entire weight of the body in walking.

ping-up," from striking the point of the foot against the opposite ankle, or any unevenness of the surface. The elevation of the heel produces a corresponding elevation of the shoulder and hip of the affected side, and prevents the patient standing with his legs close to each other. The extraordinary diminution of the base consequent on the elevation of the heel when the foot is placed to the ground, increased by the forcing inwardly of the toes, causes the

patient to support himself when standing erect by retaining the sound limb as a pillar beneath the centre of the trunk, whilst the affected limb is placed in front, widely separated, to increase the aggregate base of support afforded by the surface between the feet. His gait is very unsteady, with much jolting of the trunk and laborious movements of the arms. The affected limb is not carried directly forward, as in persons of ordinary gait, but projected with a particular semicircular movement, the knee being raised in an unusual manner to prevent the toe striking the ground. The curve of the semicircle described by the foot being directed outwardly, he thus obtains the advantage of bringing the largest possible portion of the sole in contact with the ground. The limb being placed obliquely to the ground with reference to the perpendicular line of the body, the outward tendency of the instep and the inward tendency of the point of the foot are thus partially arrested.

Notwithstanding the instinctive efforts of the patient to arrest the deviation of the foot, he states that the lameness is increasing. He has often walked to the extent of eight or ten miles during the day, but suffered exceedingly from pain and fatigue. His pace is very quick, notwithstanding that the deformity and lameness are so great. This may often be observed in persons similarly affected, produced by the great pain experienced each time the tender part of the sole of the deformed foot touches the ground. The development of the muscles of the sound limb is increased, from the additional exertion to which it is subjected; and the affected limb barely touches the ground, when he rapidly springs forward, throwing his weight on the sound limb. The instep is more convex than that of a sound foot; but the deformity of the tarsus, arising from the action of walking, resembles, although in a minor degree, that produced by the adduction and rotation of the foot peculiar to T. varus, the convexity of the tarsus being outwards and forwards, indicated by the arrows in fig. 19, and not simply forwards, as in T. equinus. The state of complete extension of the great toe, and of semi-

extension of the smaller toes, are strikingly evident in this case (see fig. 19).

The tendo Achillis, which nearly equalled in size that of the sound limb, was divided Dec. 2, 1837 (in the presence of Mr. Chaldecott of Newington, Mr. Pilcher, and Mr. Compton of Charterhouse Square). The puncture healed; and Stromeyer's apparatus was applied the second day after the operation. No greater difficulty was experienced in bending the ankle than was anticipated, considering the age of the patient and the density and firmness of the whole of the tissues. A fortnight elapsed before the ankle was bent to a right angle with the leg. Considerable tumefaction of the joint, with pain in the situation of the deltoid ligament, and tenderness of the sole of the foot, accompanied the process of extension, but these were relieved by the continued application of the spirit-lotion to the ankle, and an air-cushion placed beneath the sole. He walked in his apartment wearing the apparatus, thus assisting the replacement of the foot, and was also permitted to attend daily in his counting-house. The foot having reached a right angle with the leg, Stromeyer's apparatus was removed, and another applied, similar, in some respects, to that represented fig. 14, having a firm upright bar of steel passing along each side of the leg, by which he was enabled to walk more conveniently. During the third week, the foot advanced beyond the right angle; but its further progress was attended with pain in the direction of the peronei muscles.

My patient's satisfaction at feeling his heel touch the ground, with the consequent ability to walk much better than before the operation, and his anxiety to be enabled to give undivided attention to his affairs, rendered him unwilling to persevere in wearing the apparatus so as to obtain the power more completely to bend the ankle. This reluctance was increased by the pain with which the daily progress was attended.

At the expiration of three weeks after discontinuing the extension of the joint, and within seven weeks of the per-

formance of the operation, all tenderness and tumefaction had subsided, and the foot presented the appearance repre-

Fig. XX.—*View of the foot after the cure by division of the tendo Achillis.*

sented in fig. 20. He walked firmly and evenly on the heel and sole, and the entire carriage was so improved as to astonish all who had previously known him. Within three months after the operation he could walk four or five miles without inconvenience or fatigue, and occupy himself in a standing posture the whole of the day.

Remarks.—A comparison between figs. 19 and 20, will shew the great change in this case by division of the tendo Achillis, and by the replacement of the superior articulating surface of the astragalus beneath the axis of the tibia, permitting the heel to reach the ground. The foot now differs from the sound one by being two inches shorter, the heel projecting less backwardly, and by the comparatively imperfect development of the whole of the muscles, causing the absence of the outline of the Achilles and other tendons. The internal malleolus is less developed, from the pressure to which the whole of the parts on the inside of the ankle were formerly subjected by the inward inclination of the point of the foot. But the extent of the improvement in the external appearance of the foot is greatly exceeded by the increased comfort

and facility of walking. They only who have experienced the toil and misery endured by unnaturally treading upon so small a portion of the sole as the anterior extremity of the metatarsal bone of the little toe, as in fig. 19, can adequately conceive the change in the feelings of a person enabled by means of this simple operation to tread flatly upon the entire sole. Every step is a source of positive pleasure, and ought to prove a source of gratitude towards Stromeyer, who, by the re-introduction of the operation of dividing tendons on principles simple in their application, and, when properly conducted, certain of success, has, through the instrumentality of others, conferred this great benefit.

CASE XIII.

TALIPES VARUS CONGENITUS, AFFECTING BOTH LIMBS.

(Figs. 9 and 10.)

Remote cause—Severe derangement of the supply of motor and nutrient nervous energy to the lower extremities. Proximate cause—Spasmodic contraction and structural shortening of the adductor and so-called extensors of the foot. Cure in both feet by division of the tendo Achillis.

April 5, 1837. ****, aged 16, a stout youth, having a severe lameness and deformity of both feet; his mother states that he was born with the deformity.

Present condition. The circumstance first claiming attention is the imperfect development of the entire organisation of the lower extremities, which are disproportionately short, compared with the length of the trunk and upper extremities; the muscles of the pelvis and thighs are much below the usual standard, although they are well cased in adipose tissue, while those of the leg are even less developed. There is a total absence of the calves of the legs, from atrophy of the gastrocnemii. The shortness of each limb depends more on deficiency of the tibia and fibula than on deficiency of the femur: the shafts of the tibia and fibula are distinctly felt more slender than in a natural state. The feet are also

stunted; both heels, from the shortness of the gastrocnemii, are two inches from the ground (see figs. 9 and 10). The toes are drawn inwardly, and the inner margins of the feet upwards, from the contraction of the tibiales anticus and posticus, so that the great toes are in contact, and the patient, when he stands erect, only touches the ground with that part of the plantar surfaces of the feet termed the ball of the little toe. This part (*a*, figs. 9 and 10), an oval of the length of an inch and a half, is covered by a painful corn, from having borne the entire weight of the body. No part of the remainder of the soles, the ball of the great toe, the heel and under part of the instep, has at any time touched the earth. There is but little mobility of the ankle-joints, particularly of the left. The ligamentous tissues are very rigid; those of the inside of the feet (lig. deltoidea) are particularly contracted; the legs are both œdematous, the skin of a purple hue, from languor of their circulation; and their temperature is unusually low. These conditions co-exist with some displacement of the tarsal bones; the round head and superior trochlea of the astragalus are seen and felt projecting; the former from being partially denuded of the os naviculare, the latter in consequence of the fixed state of so-called extension of the joint. The os cuboides is also more prominent than natural along the sides of the feet. The left foot, which is commonly the case, is in all respects more deformed in the extent of elevation of the heel, in the twisting inwards of the foot, the stiffness of the joint, and the deformity of the tarsal bones. All exertion with the hands to improve the form of these feet has only the effect of rendering the Achilles tendons a little more tense.

His mode of progression is extremely laborious and difficult, although wearing boots with the heels and broad soles accommodated to his lameness. The arms maintain the equilibrium of the body; and, were it not for the agility acquired from infancy by constant practice, he would always be in danger of falling, from the absence of useful gastrocnemii, and having so very small a point of support on the earth as that afforded by the ball of the little toes. The

arms are almost constantly in motion, like those of the rope-dancer, until the body has attained its perpendicular. He alternately raises one foot over the other, giving the limb a peculiar semicircular swing, first outwardly, then forward, and lastly in an inward direction. He cannot make a single step without these boots, unless by the assistance of sticks or the arm of some person. The peculiar swing arises from the endeavour to avoid touching the toe of one foot against those of the other, and to bring to the ground as large a portion of the sole as possible; for were he to place his feet on the ground perpendicularly, their points would gradually turn still more inwardly, and the ankles outwardly, which would cause him to tread on the dorsum pedis, whereby, although the deformity is increased, progression becomes less laborious, as we find in the worst cases, such as that represented figs. 5 and 6. His mother states that he has worn various mechanical contrivances to overcome the distortion, but the feet are at present in the state in which they were at birth, except that the toes are drawn somewhat less inwardly.

Directed to remain in bed, and to take every other day *calomel with jalap,* one scruple, with the intention to procure the disappearance of the œdema, and thus restore the parts to a more fitting state for undergoing the operation.

April 11, 1837. Divided both the Achilles tendons (Mr. John Scott, Mr. A. Hamilton, Dr. Straeter, and Mr. R. W. Tamplin being present).

Second day. Both punctures have healed, without his having felt the slightest uneasiness in the divided parts. He takes his usual diet.

Third day. Applied Stromeyer's foot-board to each limb; I have not yet attempted any extension, consequently no separation of the ends of the divided tendons has been effected. It is desirable that the patient should be gradually accustomed to the apparatus; for when extension is too early applied, the pain often becomes almost insufferable, the simple wearing of the foot-boards without the exercise of extension being at first a source of uneasiness.

Seventh day. He has suffered some pain, but sleeps well. Walks about the room with the foot-boards and the assistance of sticks; both heels have somewhat descended.

Fourteenth day. The heel of the right foot touches the foot-board at a right angle; the left foot is not so far advanced. On the dorsum of the right foot, above the metatarsal bones, there has been a vesication, from the pressure of a strap having retarded the return of blood from the front of the foot. Cotton wadding has been applied, and it is again covered with epidermis. He has had two or three restless nights, and complains of the upward pressure of the foot-pieces of the apparatus against the corns on which he formerly trod.

Third week. The heel of the left foot touches the foot-board at a right angle with the leg. He takes exercise in his apartment freely.

Fourth week. Both feet are bent at an acute angle with the leg. The entire soles therefore touch the ground on standing without the apparatus, although there still exists a greater concavity in the internal aspect of the arch of the foot than in a sound limb.

Fifth week. He now wears the modified Scarpa apparatus represented fig. 14, with which he walks without the assistance of sticks.

Sixth week. He has acquired considerable freedom of locomotion. His walk is firm and regular, although the muscles of the leg, having little power of contraction, and the ankle-joints being tender, from the extension their ligaments have necessarily undergone (in order for the first time to admit the trochlea of the astragalus into the tibio-fibular cavity), merely permit the feet and legs to be used as passive organs of support. The trifling development of the muscles of the calf reduces him to a condition similar to that of a man of advanced years, who, from wasting of the calf, is unable to rise on the toes.

Seventh week. He daily improves; but, from being so long accustomed to the semicircular motion already described, experiences considerable difficulty in maintaining

an absolutely erect position, notwithstanding that his feet are now firmly applied to the ground, His gait is nevertheless so improved, that his friends can scarcely recognise him. I have directed him to carry in each hand a weight of several pounds, by means of which he is enabled to walk better, as the muscles of the upper part of the trunk when thus employed cause the body to become more erect. In fact, he is compelled to learn the use of his legs in the manner of a child, without possessing the normal state of the muscles which exists in infancy.

Sept. 1st, 1837. He can walk daily ten or twelve miles without difficulty, in his capacity of errand-boy. It could not be surmised that he formerly laboured under congenital club-feet: the only remains are a slight turning inwards of the toes when fatigued, and a consequent carelessness in his gait; but there still exists an absence of the natural freedom of action in the ankle-joints. The mass of muscles has evidently increased. After the tenth week, he discontinued all apparatus, and has since worn a pair of common lace-up boots, stiffened by the addition of a thin steel busk, sewn on the inner side of the ankle, between the lining and outer leather.

Remarks.—It cannot be doubted that the deformity was produced during uterine existence, by some violent derangement of the innervation of the lower extremities, from which resulted the deficient nutrition and derangement of motor nervous energy. It could not, therefore, be expected that any means adopted for the restoration of the form and function of the osseous part of these feet could at the same time effect a cure of the lesion of the central organs of the nervous system, by which their capillary and muscular systems had been so intensely affected. The complete restoration of the function of the muscles must be incomplete, in all equally advanced instances of congenital Talipes varus; but the reduction of the foot to a proper form, by enabling the patient to stand evenly and firmly on the soles of the feet, furnishes two efficient passive organs of locomotion, and

affords the opportunity for the muscles of the thighs and hips, if not implicated in the original mischief, to increase in strength and become developed to the natural extent. In this manner the operation of dividing tendons is, even in extreme cases, very successful. A considerable distance can be daily traversed without pain or fatigue; and after the lapse of sufficient time, and by dint of practice, the individual walks with very slight appearance of lameness.

CASE XIV.

TALIPES VARUS ACQUISITUS.

Non-congenital club-foot of the right side, depending on spasmodic contraction of the gastrocnemii and other posterior muscles of the leg, and more particularly of the muscles of the sole. Cured by division of the tendo Achillis and tendon of the flexor longus pollicis muscle.

July 6th, 1838. ****, ætat. 13, a boy of slender frame, who has enjoyed good health for several years, lost during childhood the use of the right leg. His mother states that subsequently the left leg became affected; in her opinion, from the whole of the exertion in walking having devolved on it. At the present time, both limbs are much thinner than usual in boys of his age, the muscles being very sparingly developed, and the bones more slender than common. The thighs, knees, and legs are perfectly straight, but on standing erect the right ankle-joint is extended so that the extremity of the heel is elevated an inch, and the whole of the fore-part of the foot is twisted inwards to so great an extent, that no part of the sole touches the earth. He treads exclusively on an oval surface of two inches in length, corresponding to the *external* surface of the fifth metatarsal bone, the appearance of the foot greatly resembling that represented in fig. 9, but the convexity of the tarsus is much greater. The tendon of the contracted long flexor muscle of the great toe is very prominent in the sole of the foot, which is consequently extremely hollow, the heel and the

ball of the great toe being drawn nearer to each other than in figure 10. In the act of walking, the heel becomes more elevated; and the foot is likewise further twisted inwardly, partly in consequence of the contraction of its adductor muscles being then increased, and partly by the foot being thrust inwardly, and the inferior extremity of the tibia yielding in the opposite direction between the action of the two opposing powers—the weight of the body and the resistance of the earth. The lateral mobility of the ankle is so great, that when the patient is seated, the point of the foot may be drawn so far outwardly that, but for the great convexity of the tarsus, the deformity might be described as T. equinus; the convexity, however, being very great and principally outwards, justifies the denomination of T. varus.

The left foot would only attract the attention of a casual observer by its muscles being imperfectly developed; but on careful examination it is evident that this foot is affected with a similar contraction, although but slightly; for on the patient attempting to bend his knee, the heel rises from the ground, indicating that the ankle cannot be flexed beyond a right angle with the leg, owing to a shortness and rigidity of the gastrocnemii. This limb is, notwithstanding, equal to the ordinary necessities of locomotion; it is consequently unadvisable to attempt any operation for its improvement.

July 28th, 1838. Divided the tendo Achillis and the tendon of the flexor longus pollicis. The small punctures united within a few hours, and on the second day, cicatrisation being perfect, the instrument represented in fig. 14 was applied, and the full extent of flexion of the ankle obtained by a gradual advance of the screw *l*. But little pain was experienced whilst wearing the instrument, from the mobility of the ankle-joint and laxity of the internal and posterior ligaments which existed prior to the operation. The chief cause of uneasiness arose from the action of the spring *d*, tending to diminish the inward curvature of the tarsus and metatarsus by elongating the fibres of the deltoid and other ligaments and the contracted muscles of the sole. Sensations of cramp in these muscles proved that they were sub-

jected to an extending force. He was allowed to take exercise, by which means the flattening of the tarsal arch and bending of the foot were facilitated. At the expiration of three weeks the complete restoration of its position was accomplished, although there still remained a more than natural degree of concavity of the sole and convexity of the instep. He was recommended to continue the instrument for another fortnight, to maintain the foot in its proper position during the consolidation of the union of the tendons.

He was subsequently permitted to wear a lace-up boot, stiffened on the inside with a thin steel busk. He went to the Margate infirmary, for the benefit of sea-bathing and the improvement of his general health; and on returning, within the period of four months from the performance of the operation, walked extremely well, the operated limb being the more serviceable one, the increased convexity of the tarsal arch being a source of firmness to the gait; for the obliteration of the tarsal arch of the left foot had caused a considerable weakness in this extremity, from having for several years borne the greater part of the weight of the body.

Remarks.—The frequency of the existence of a similar affection in both feet when one only is made the subject of complaint, or without the individual being aware of the circumstance, is remarkable. Thus the subjects of Cases I. and V. were unable to bend the foot they considered perfect beyond a right angle with the leg—evidence of a slight contraction of the gastrocnemii; in Case I. there was a contraction of the ball of the great toe towards the heel in the foot regarded as sound, similar to that of the deformed foot, indicating that the flexor and abductor muscles of the great toe participated in the spasmodic affection. In Case V. there existed in both feet a strong permanent incurvation of the phalanges of all the toes, proving that their flexor muscles preponderated over the extensors. In several of the individuals affected with T. equinus whom I have cured by division of the tendo Achillis, and who had passed the age of adolescence, I have observed that although the motions of

the ankle and toes were perfect in the sound limb, yet the form of the foot bore some general resemblance to T. equinus, in shortness and breadth, and in a greater convexity of the tarsus than that which characterises a well-shaped foot. This I have considered to depend on a greater degree of power than is usually possessed by the aggregate mass of muscles in the sole, through which, either previously to the ossification of the bones of the tarsus, or during that process, the peculiarity of form had been imparted to the foot.

CASE XV.

TALIPES VARUS CONGENITUS.

Congenital club-foot of the left side. Cured by division of the tendo Achillis.

MASTER ****, ætat. five and a half years, was born with a distortion of the left foot, which his father, a member of the medical profession, states to have been greater at the period of birth than at present. The heel is elevated two inches (see fig. 21), and the fore-part of the foot is directed internally, though not to a great extent; but the slightest pressure with the hand suffices to give it the appearance of the highest grade of T. varus, as in fig. 5, which, from the statement of the father, was its condition at birth. The hinge-like articulation described page 112 therefore exists between the anterior series of tarsal bones (consisting of the os naviculare, os cuboides, and cuneiform bones) and the posterior tarsal bones (the ossa naviculare and calcis).

October 4th, 1837. The tendo Achillis was divided; and on the third day after the operation, the puncture having united, the instrument represented page 34 was applied. The toes were gradually pressed upwards, and within a fortnight the heel was brought in contact with the earth.

The continued wearing of the apparatus was recommended for a month, on the expiration of which the patient walked without pain in the ankle-joint, and was able to place

FIG. 21.—*Congenital T. varus of a child æt. five and a half years.* The foot is represented in the position to which it was brought by pressing the toes outwardly with the hand. When the patient walked, the foot, unless supported by an instrument, was thrust so much inwardly that its inner margin was situated at a right angle with the inner surface of the tibia, as in figs. 5 and 23.

the entire sole evenly to the ground, instead of walking on the external surface of the os cuboides and fifth metatarsal bone, as he had done previously to the operation. A considerable degree of incurvation of the front part of the foot remained, not arising from adduction of the ankle-joint, but from the individual bones of the tarsus and metatarsus being drawn inwards by the contraction of the muscles of the sole. The reader may comprehend the position of the foot at this period by referring to fig. 21, taken before the operation, and conceiving the sole, instead of presenting backwards (the foot being in an extreme state of extension through the elevation of the heel), perfectly horizontal, with the same degree of inward inclination of the toes remaining. As the patient could now walk with only a very trifling

appearance of lameness, and it not being probable that the shortened muscles of the sole would be rapidly elongated, I recommended an instrument similar to that in fig. 14 to be attached to a common boot, in the expectation that amendment of the tarsus would ensue by constant exercise, the foot being held in a proper position. I was not disappointed in these hopes, having on each subsequent examination witnessed a manifest improvement; this in the spring of 1838 became so considerable, that he could walk well wearing a common boot. The application of the instrument was therefore discontinued; but in order to afford for some time longer a certain degree of support to the ankle, a thin steel busk was inserted between the lining of the boot and the outer leather.

Remarks.—The history of this case illustrates the observations appended to Case VIII. with reference to the nature of the benefit attainable by the application of mechanical instruments alone. This patient had been from the period of birth most assiduously treated by his father, a gentleman possessing no ordinary knowledge of the nature of these affections and the means for their cure. Notwithstanding the daily care and attention bestowed on the foot, and experiments with various apparatus suggested by different mechanists which the parent considered adapted to produce elongation of the gastrocnemii muscles, the improvement effected in the position of the foot consisted only in turning the foot outwards to the point at which it is represented fig. 21, and but slight elongation of the gastrocnemii had taken place. On mature consideration, and after numerous opportunities of observation, I am enabled confidently to assert that by division of the tendo Achillis and the application of the apparatus fig. 14, in this case and those of Nos. II., III., V., VII., VIII., XI., and XII., as great an improvement resulted within one week as had been previously obtained by years of mechanical treatment, the continued perseverance in which could, moreover, never have effected a cure.

CASE XVI.

TALIPES VARUS CONGENITUS OF BOTH FEET (Fig. 3).

Congenital club-foot affecting both extremities. Cause—spasmodic contraction with structural shortening of the extensors and adductors of the feet. Cured by division of the Achilles tendons.

June 11th, 1838. ****, aged 20 months, is stated by his mother to have been born with distortion of both feet. The treatment hitherto pursued has consisted in enveloping each foot with adhesive plaster, and securing it by strips of the same in a strong tin splint. This plan was commenced when the infant was a month old, and was continued for six months, during which the mother attended on alternate days in the out-patients' room of one of the metropolitan hospitals. The infant experienced great pain, and frequently had excoriations in various parts of the limb; and as no amendment took place under the treatment at the hospital, the mother became disheartened, and discontinued her attendance. She was subsequently advised by her medical attendant to rub the feet at every opportunity, and endeavour to turn them outwards, and force the heels downwards. A slight improvement has rewarded her exertions, as the toes are less twisted inwards, although the elevation of the heel is undiminished. At the present time (see the drawing of these feet, fig. 3) each heel is drawn upwards by the contracted gastrocnemii muscles to its fullest extent; and the front part of the foot is so considerably directed inwards and upwards by the contraction of the adductor muscles, that the line of the inner margin of the foot forms a right angle with the perpendicular line of the leg, and the accompanying rotation causes the sole to be nearly vertical. The great toe is observed not to reach forward so far as is usual in a sound foot. The external malleolus appears to have receded; and the internal malleolus is so completely embedded in the tissues at the junction of the angle formed by the inner margin of the foot with the leg, that it cannot be felt.

The treatment of this case was commenced by bandaging each foot in a tin splint (fig. 24), the foot-part of which

forms an angle equal to the degree of the extension of the foot. The object of applying this splint is not to endeavour to force the toe upwards in the slightest degree, which can be more readily effected after division of the tendo Achillis, but by directing the toes outwards to retain the foot in a straighter position for a short time previously to the operation.

June 25th. With the assistance of Mr. Dale, of King's Place, Commercial Road, who attended the case with me, I divided the tendo Achillis of the left foot, making a puncture little larger than that of a needle ; a strip of adhesive plaster, and a bandage, with pasteboard splint, were applied as in the preceding cases, to support the foot in a quiet state. It was my intention to have divided the tendo Achillis of the right foot also ; but on removing the bandage and tin splint, I found there existed a slight redness of the skin with œdematous swelling, from the splint having been the preceding day too tightly applied. I was therefore induced to defer the operation for two days, as division of the tendon in a foot thus slightly inflamed from pressure might interfere with the immediate healing of the puncture.

June 27th. The puncture in the left foot completely healed. The redness and œdema which caused the postponement of the operation on the right foot having disappeared, division of the second tendo Achillis was accomplished. The application of apparatus to the foot first operated is deferred until the puncture in the right foot is healed, as the restlessness frequently occasioned by the apparatus on its first application might cause sufficient disturbance of the general health to impede the closing of the second puncture by adhesion.

June 29th. Puncture in the right foot united ; the cicatrices are so small that a person who had not witnessed the operations would have some difficulty in detecting the places where they were performed. Not the slightest symptom of pain, restlessness, feverishness, or other disturbance of the system, has occurred since the operation. The child takes his food, and appears in usual health and spirits. I have

this day applied to each foot the modified Scarpa shoe (fig. 14), taking care that very little pressure is made on any part, and that only slight tension of the lymph effused between the ends of the tendon or of the cutaneous and other tissues on the posterior and inner part of the ankle and foot is produced.

The following day the report was, that the child had been somewhat restless, and had at times cried out, as if in pain, but had slept better than the mother expected. I believe that whatever the child may have suffered has been produced rather through the general uneasiness resulting from having the feet secured in a fixed position for a number of hours, than from any positive pain induced by the gradual extension to which the muscles and ligaments left undivided in the operation are subjected.

From this period the mother continued to bring the child regularly to my house, twice and often three times daily: early in the morning, to have the straps secured anew, and the tension exercised by the screw *l* and the spring *d* increased, or, if necessary, the apparatus removed and reapplied; in the day-time, in order that the pressure might be moderated, if it had been too much increased; and at night, when requisite, to obtain the relaxation of the straps and the tension exercised by the screw and spring, with the view of preventing the child having its rest disturbed.

The application of the instruments at first interfered more with the repose of the child than at a later period; the mother stated that after they had been worn for three or four days, he readily fell asleep at his usual hours.

July 11th. The bending of each foot is so far advanced, that were the child accustomed to stand, the heel and entire sole would be applied to the ground; they also appear quite straight when examined in the instruments. On their removal the improved position of the feet continues. The adduction has likewise greatly diminished, as there exists but a very trifling inclination inwards of the point of the foot, the position of the left being in this respect better than that of the right. This great amendment has been effected by

the application of so little force, that not a single vesication or discoloration of the skin has been produced.

At the expiration of a month after the operation, the bending of the ankle was complete in both feet, without any inclination inwards when the child was placed upright on the ground, and with but a trifling degree even when the feet were allowed to hang unsupported at the toes. The tendency to œdema, and occasionally to inflammation of the skin, and the resistance offered by the deltoid ligaments and the undivided muscles at the back of the leg, had required great vigilance in moderating, and, when necessary, increasing the pressure exercised by the instruments. Both the bandage applied next the skin and the instruments had been removed every morning, to ascertain which part of the foot had been most compressed; and were then carefully reapplied, with wadding so interposed as to obviate pressure upon any part to which its application was considered unadvisable. The mother was now desired to undertake the removal of the instruments morning and evening, to rub the feet well on every occasion with a liniment;* and to move each ankle alternately upwards and downwards for several minutes in the direction of flexion and extension, particularly preventing the toes turning inwards into their former vicious position. The child having evinced a disposition to walk, the mother was desired to assist him in his endeavours. A wedge-shaped piece of cork was fastened to the under part of each instrument, one extremity of the wedge, an inch and a half in thickness, being placed beneath the extremity of the toes, and the thinner part beneath the middle of the sole, the object being to support the toes and maintain the foot during the act of walking in its newly acquired bent position, until the fear was dissipated of any contraction occurring in the medium uniting the severed tendon.

* ℞ Ammoniæ hydrochlor. ʒj.
Linim. saponis,
Linim. camphoræ, āā ʒj.
M. ft. linimentum.

This plan was persevered in for four weeks longer, the child not having experienced any pain since the feet were bent beyond a right angle with the leg. The mother reported that he slept as well as if he had not worn any instrument, his appetite was good, and that he appeared in excellent health. He was now enabled to move across a room with the assistance of the chairs. The position of the feet being at this time perfect, the ankles freely capable of motion with the hand in every proper direction, and flexion and extension being voluntarily made, the application of the apparatus was discontinued during the day and the child permitted to walk in common lace-up boots, supported on both sides by a thin slip of iron sewn between the lining and the outer leather.

Oct. 1, 1838. The child is already able to walk without assistance, and places his feet extremely well on the ground. They have much improved in appearance since the last report,

Fig. 22.—Case XVI. after the cure, no deformity remaining.

the œdematous thickening of the parts around the ankles having disappeared; they have also grown considerably, and the muscles of the calf have become more developed. With the exception of the comparative smallness of the calf of each leg, not the slightest symptom of club-foot remains.

Remarks.—There are many subjects connected with this case which suggest observations on the management of club-foot in infants, which I shall defer until I have detailed another much resembling it. It may, however, be remarked, that the observations on the amount of benefit conferred in Case VIII. (page 112) by the application of mechanical means prior to the operation, are perfectly applicable to the present case.

CASE XVII.

TALIPES VARUS CONGENITUS.

Congenital club-foot of both extremities. Origin—Spasm and structural shortening of the extensors and adductors of the feet. The right foot cured by division of the tendo Achillis and the tendon of the posterior tibial muscle; the left, by division of the tendo Achillis only.

March 1st, 1838. ***, aged two years and eight months, is stated by his mother to have been born with a deformity of both feet. She attended with him for several months as an out-patient at an hospital, but witnessing little amendment, she at length ceased to attend; and her means being inadequate to the purchase of any mechanical instruments, the hope of the child's recovery vanished. As he advanced in age he was allowed to use his feet, through which the deformity has increased. At present he can move across an apartment with considerable rapidity, although, as no part of the sole of either foot touches the ground, and none of the muscles perform their proper function, he cannot be said to walk. In short, the limbs are mere passive organs of support, his gait resembling that of a person on two wooden legs.

The *right* foot (represented at fig. 23) is more deformed than the *left*, and will serve to illustrate the severe grade of congenital T. varus in children—the extension, adduction, and rotation peculiar to this deformity being strikingly characterised. A considerable callosity has been gradually formed

on the dorsum of the *right* foot, and a smaller one on the *left;* and a degree of thickening exists of the ligaments connecting the tarsal bones, with a probable partial displacement of their articular surfaces. These complications, occasioned by attrition against the earth and the improper pressure

FIG. 23.—*Congenital Talipes varus of the right foot in a child aged two years and eight months, Case XVII.* The drawing represents the foot in the position to which, prior to the commencement of the cure, it could be reduced by pressing the toes and front part outwards. The outline of the front part of the foot *a* shews the extent of the deformity when relinquished to the free action of the muscles, or when the child attempted to walk. The letter *b* indicates part of the external malleolus, presenting more posteriorly than in the sound foot; *c*, a callosity protecting the os cuboides and its articulation with the os calcis from the effects of pressure; *d*, the heel elevated to the utmost extent behind the tibia and fibula; *o*, external angle of the trochlea of the astragalus, visible through the integuments in consequence of the elevation of the heel. Had the deformity remained uncured until adolescence, it would in all probability have equalled that represented in figs. 5 and 6.

exercised through treading in so unnatural a manner, offer, in addition to the contraction of the adductor muscles, an

insuperable obstacle to turning with the hands the point of the foot outwards to a greater extent than that represented in the accompanying figure.

March 5th. The treatment has been commenced by bandaging a straight splint (of strong pasteboard and thickly covered with cotton wadding) upon both sides of each leg.

March 20th. The bandaging was daily renewed until the 16th, when, as the pasteboard splints were not sufficiently strong, others made of tin were substituted. The feet are evidently advancing in the required direction, under the gradual application of pressure, there being less inward twisting of the toes, and the callosity on the back of the foot being softer.

March 24th. Divided the tendon of the posterior tibial muscle in the *right* leg, and, after dressing the puncture, applied a single pasteboard splint to prevent motion of the joint during cicatrisation; the application of the tin splint is continued to the left foot.

April 12th. A tin splint was applied to the *right* foot three days after division of the tendon of the posterior tibial muscle. Both feet appear equally improved, being much straighter and partially converted from T. varus to T. equinus; but the *left* foot, on the removal of the tin splint which holds it straight, relapses almost to the same degree of deformity which existed prior to its application (through the contraction of the anterior and posterior tibial muscles); whereas the *right* foot, on which the operation was performed, and which presented the greater deformity, although partially drawn inwards, on the removal of the splint better retains its improved shape. A diminution of the adduction of this foot is therefore the effect of division of the posterior tibial tendon.

May 7th. Since last report the child has had the chicken-pox, accompanied with sufficient indisposition to have occasioned for a few days a cessation of the improvement. Both feet are now maintained in the position of T. equinus, although, when the splints are removed, the inward inclination of the *left* foot is considerable, whereas that of the *right*

is but trifling. Divided this day the Achilles tendon in each leg; and after dressing the punctures, bandaged pasteboard splints loosely on the feet, with the view to prevent motion in the divided parts.

9th. The punctures have united; the feet appear to hang motionless, the ankle-joint being comparatively loose, which is usual after division of tendons. Both feet are inclined more inwardly than on the removal of the tin splints before division of the Achilles tendons, although the inclination is greater in the *left* foot, in which the posterior tibial tendon has not been divided. This relapse results from discontinuance of the application of the tin splints during the last three days, in consequence of the operation; but this will be quickly compensated by wearing the modified Scarpa apparatus (fig. 14), by which the remainder of the extension necessary to reduce the foot will likewise be effected.

June 7th. Each foot can be bent beyond a right angle with the leg; but the resistance of the ligaments of the joint, and the contraction of the muscles undivided at the operation, are not sufficiently overcome to permit the feet remaining in their proper position when unsupported by the hand or the apparatus. The child, on being desired to stand, touches the ground with the inferior surface and entire sole of the *right* foot, but only with the heel and external portion of the sole of the *left*. The continuance of the apparatus was therefore necessary, in order completely to overcome the resisting tissues, and which constituted the slowest part of the cure. But before another month had expired, the callosities on the dorsum of the feet had disappeared, and the child had been enabled to take much exercise whilst wearing the apparatus, which had produced the effect of elongating the contracted tissues about the inner malleoli, and considerably flattening both feet, particularly the *right* one. The elongation of the undivided muscles and ligaments now appeared so complete, and the child made such progress in walking, even with a wedge of cork of considerable thickness beneath the toes (applied for the purpose described p. 162), that no reasonable fear of relapse could exist. Being desirous of

affording him the benefit of country air, his health having in some degree suffered through frequent nightly disturbance, the chicken-pox, and the commencement of hooping-cough about this period, I dismissed the patient from daily attendance, desiring the continued application of the apparatus.

At the end of July I again saw the child; he appeared in perfect health, although stated still to have the remains of hooping-cough. He walked well, and ran quickly across the apartment, the only appearance of lameness arising from imperfection in the function of the gastrocnemii; the flexion of the feet was perfect, although he still trod more on the outer than the inner side of the sole of the *left* foot. I recommended the removal of the cork from beneath the toes, and that he should wear boots similar to those of the subject of Case XVI.

Remarks.—The progress of Case XVI. illustrates the uninterrupted and speedy cure of an instance of Talipes varus, not of the mildest grade; and it will readily be conceived that slighter cases, in which the foot before the commencement of the treatment could be more nearly reduced to its proper form, and cases of T. equinus in young children, would be proportionably more easily remedied. Thus the application of the slightest pressure with the apparatus frequently suffices in a few days, after the division of the necessary tendon or tendons, to cure the deformity without pain, or the disturbance of a single night's rest; and the sole necessity for wearing instruments during a few weeks arises from the possibility of contraction supervening in the divided parts. Case XVII. was more severe; but the cure was effected without difficulty, although a longer continuance of the mechanical part of the treatment was requisite.

The latter case is interesting in relation to the utility of dividing the tendon of the posterior tibial muscle in similar instances of deformity. It was observed on the third day after its division, that the inward twisting of the foot was not entirely removed. This can be easily accounted for without doubting the utility of dividing the tendon. The

causes which maintained the adduction and rotation peculiar to varus (fig. 23) were of an active and passive nature. The active consisted of the contraction of the tibialis anticus and posticus and flexor muscles of the toes; the passive, the shortening of the ligaments on the inside of the tarsus, consequent on the long-continued abnormal position of the foot and the thickened and consolidated state of the tissues on the outer side of the tarsus, produced by the attrition and pressure to which the part was exposed in walking. The division of the tendon of the tibialis posticus muscle effected the removal of only one cause of the inward twisting of the foot; but it sufficed greatly to relieve one of the most troublesome symptoms of severe congenital T. varus—the elevation of the inner margin of the foot from the ground—a symptom which frequently remains after division of the tendo Achillis only, and effectual bending of the ankle. I did not consider division of the tibialis anticus muscle necessary for the cure of this foot, partly on account of the tender age of the patient, which justified greater expectations from the employment of mechanical means of elongation, but more particularly from having observed in similar cases that as the function of this muscle is to bend the foot as well as to adduct it, its relaxation has been effected when the foot is bent. In addition to which, from the natural form of the ankle-joint, the contraction of the anterior tibial muscle can only adduct the foot during elevation of the heel through the action of the muscles of the calf; for when the foot is bent, the action of the anterior and posterior tibial muscles is simply to raise the inner margin. I have operated on seven other cases in children resembling the present case, and in each the difficulty of cure was in proportion to the degree of secondary mischief inflicted on the tarsus by the child having previously attempted to walk. In one of these instances, in addition to the section of the tendo Achillis, I divided the tendon of the flexor longus pollicis, which materially assisted in the restoration of the foot. In the whole of these cases I succeeded in reducing the foot to

a proper form within a period varying from six weeks to three months.*

In Case XVI., I have mentioned the production of inflammation of the skin from pressure of the apparatus. In the treatment of children, it is highly important to be aware of the possibility of this event, which has frequently occurred in cases where the practitioner, from want of sufficient experience in their management, has incautiously hurried the reduction of the foot. This inflammation is an occurrence which, from the vascularity of the skin in early life, may be produced by comparatively slight pressure. In the majority of cases, the effect of the pressure is limited to the production of an increased vascularity without positive inflammation. I have noticed that the amount of pressure which in a person of maturer age would have produced a vesication limited to the spot actually exposed to it, will in an infant induce redness of the entire limb. It would therefore appear that in the adult the minor vascularity of the integuments limits the operation of the pressure to the part actually in-

* One case alone caused me uneasiness. It was congenital Talipes varus in both feet, æt. twenty months, in which, after great attention, complete bending of the ankle-joints was obtained. The attendance of the child at my residence, and the application of the instruments by which the necessary extension had been effected, were recommended to be continued; but the feet appeared cured; and the father, who had daily to bring the child a considerable distance, thought that he could attend to their further treatment, and absented himself for several months. When at length the child was again presented to me, I found that the directions respecting the employment of frictions, manipulations, bathings, and the proper application of the instruments, had been neglected, the latter being completely destroyed, and that the distortion had partly returned. I obtained from a charitable institution another set of instruments; and the father promised that he would thenceforward attend regularly, if I would again gratuitously undertake the cure. I performed anew the division of the Achilles tendons, and applied the instruments on the healing of the punctures, but to no purpose; as three days afterwards, on my complaining that he had not on the previous evening attended according to my request, he behaved so rudely and ungratefully, that I was under the necessity of discharging him from further attendance. My sensitiveness on behalf of the reputation of the Stromeyerian plan of dividing tendons must be pleaded as an apology for introducing the relation of this instance of the ingratitude occasionally evinced by individuals *gratuitously* benefited.

jured; whereas in infants the high organisation of the skin facilitates the extension of the mischief: hence the great care requisite in the treatment of such cases. It is fortunate for the success of the operation that any unpleasant symptom may always be avoided, if the subsequent reduction be not too rapidly attempted, the apparatus be daily removed, frictions of the limb resorted to, and the parts protected by the careful application of wadding beneath the bandages and straps of the apparatus.

Another point in the history of Case XVII. is the imperfection in the function of the gastrocnemii, described to have existed at the date of the latest report after the cure of the distortion. The proximate cause of Talipes is physical—the contracted state of certain muscles—the removal of which by the operation is direct and immediate; but the indirect benefit anticipated to result is slower of attainment (page 55), and varies according to the severity of the case. The *extent* of the distortion in congenital cases, *i. e.* the occurrence of T. equinus, T. varus, or T. valgus, depends on the number of muscles involved; but the *severity* of the affection is in proportion to the earliness of the period at which, during uterine existence, the primary disturbance of the nervous system took place, and whether this was confined to the voluntary motor, involuntary motor (reflex), or organic functions of the muscles. It is certain that in severe cases the whole of the sources of innervation suffer; it must consequently be expected that in such cases, to whatever extent the distortion may be remedied, the function of alternate voluntary contraction and relaxation of the muscles involved must continue imperfect, although the operation, by restoring the form and mobility of the articulations, proves the most serviceable stimulus to the acquirement of the function when it is simply abeyant. See the results of Cases I., II., V., VII., X., XI., XII.

An opportunity is here afforded for a few observations on the circumstances attendant on T. varus in children, and the necessary treatment of such cases in general. It may,

in the first place, be stated that, provided the method of cure to which we resort be certain of success, and unattended by the chances of relapse, the length of time required to effect it is of less consequence in children than in adults. The circumstance of children not comprehending the object of the treatment, nor the necessity of the pain or irksomeness to which they are subjected, combined with the greater susceptibility to the injurious effects of continued disturbance of rest peculiar to their age, and their liability, when the general health is disturbed, to be affected by any of the prevailing infantile epidemics, are the reasons why children cannot on the whole bear as unremitted an application of mechanical instruments as is occasionally necessary in adults; it is therefore fortunate that the facility of effecting a cure is so much greater at this period, with reference to the degree of resistance to be overcome. The whole of the congenital cases of T. equinus and T. varus, and a large proportion of those which occur after birth, are presented to the surgeon for relief during infancy; it is consequently of the utmost importance strictly to define the plan of treatment to be pursued at this early period of existence (p. 26). Among the infantile cases, as among those in persons of maturer age, there are many in which the deformity may be nearly or entirely removed for the moment by pressure with the hands; but others exist in which the tension of the contracted muscles is so great, particularly of the gastrocnemii, that although the adduction and rotation of the foot may, as long as the pressure of the hand is continued, be more or less completely overcome, yet the greater part of the elevation of the heel remains. The former afford greater prospect of success by the sole application of mechanical means of cure; but in many of the latter a cure of the deformity will not be obtained without the division of the Achilles or other tendons, although the treatment may be commenced within a few weeks after birth, and be very perseveringly continued throughout the whole period of infancy.

This opinion is probably opposed to that of many of the profession, who may not have especially devoted their attention to the subject; but it is not an opinion formed without

ample opportunities of observation within the range of my own practice, both in cases which I have treated solely by the application of mechanical means, as in the numerous cases which I have cured by operation, after the labours of others had been totally fruitless in attempting the cure by instruments alone. In the remarks appended to Cases VIII. and XI., I have already demonstrated some of the difficulties of the instrumental method of cure alone, and (page 136) explained one reason why the profession may have been induced to suppose a larger number of cases of club-foot to be curable without operation than is actually the fact. The existing generation of adults affected with club-foot has undergone an ordeal of successive attempts at cure by mechanical means, as regularly as the routine treatment of the cases of hysteria or neuralgia denominated incurable. The treatment probably commenced a few weeks after birth, by daily frictions, manipulations, and the application of strips of adhesive plaster and a splint of pasteboard, wood, or metal, aided by the figure-of-8 bandage, to which even Hippocrates resorted, although in modern times undignified by sundry appellations derived from the names of persons who have successively recommended it. This plan, after a few months, has been discontinued from various causes, such as the necessity of at least one daily removal of the plasters, bandages, and splints, and in particular instances, more frequently, from their becoming soiled by the discharges of the infant, or disarranged by the movements of its limbs; or owing to the disturbance of comfort and rest, the occasional production of excoriations through the slightest inattention, the occurrence of some ordinary infantile disease, or in consequence of the necessary expense, and occasional loss of patience on the part of the parent or attendant. To this has succeeded the employment of some particular kind of shoe or instrument, which, if the case be T. varus, may by its judicious arrangement have held the foot in the position of T. equinus better than the common splint, have partially depressed the heel, and induced sanguine hopes of success. The period having arrived when the child has shewn a disposition to walk,

which is usually later than in sound children, the distorted foot has been subjected to a severe test. The act of walking was considered favourable to the depression of the heel; but as this did not immediately ensue, the fore part of the foot inclined to yield inwardly beneath the weight of the body, unless the instruments were admirably adapted to hold the foot in the position of T. equinus; should this not have occurred, the spasm of the muscles on the back of the leg on which the deformity depended was often increased by contact of the foot with the ground (pp. 42 and 105). Various instrument-makers were then successively consulted: each recommended a curative contrivance, as an improvement on the preceding one; until at length the medical attendant had pronounced the case incurable, or the parent had spontaneously arrived at this conclusion, which was followed by the abandonment of all curative efforts; the sole object having been to provide for the sufferer the description of "iron" which would enable him to walk with the least pain and inconvenience. But this may in many cases have been dispensed with, and the deformity has consequently gradually increased from the causes already sufficiently detailed. Such has generally been the result in the more severe cases even among the higher classes of society.

Experience alone can enable the practitioner to determine with any degree of certainty whether the cure of Talipes in an infant is obtainable by the application of mechanical means; but in the formation of his opinion he will be guided by the extent to which the deformity can be removed by the hand, and the nature of the resistance offered by the muscles. Should this be considerable, and of a passive character, depending on structural shortening, the mechanical plan may be expected to succeed (vide "Remarks" on Case II.); but if the muscles be still influenced by any cause disturbing the functions of the spinal cord—in short, if the active spasmodic state of the muscles still appear to exist, notwithstanding the foot may for a moment be reducible to its natural form with the hand,—the practitioner should be less sanguine of a permanent cure by means of instru-

ments. But I would recommend for several reasons that in every case of Talipes, the treatment of which can be commenced previously to the age of twelve or fourteen months, the cure should be attempted by the application of mechanical means. Many cases are curable without operation. Interruptions in the treatment are, from various causes, more liable to occur during the earliest months of existence. If the treatment be mechanical, a temporary suspension of the extending power exercised by the apparatus is not fatal to the ultimate success of the plan; but if, after the performance of the operation at so early a period, a necessity should arise for discontinuing the wearing of the extending apparatus, a loss of time would probably occur, during which the divided tendon might firmly reunite, the cure be as distant as prior to the operation, and a repetition be consequently required. But were the operation perfectly successful, and the foot entirely reduced to a proper form by the application of mechanical contrivances for a few days or weeks, it would still be necessary to retain the foot in its newly-acquired position by means of apparatus, until the child should arrive at an age to walk; for in consequence of the tendency to contraction occurring in the medium which unites the divided tendon, the deformity would probably be reproduced, were this precautionary measure neglected.

Another reason for treating infantile cases without division of tendons, is the objection which, on general grounds, may be made to the performance of any operation, however simple, during the earliest months of existence.

The most favourable period for the division of tendons in infantile cases of Talipes, when deemed absolutely necessary, is immediately before the time when the child may be expected to make the first attempts to walk—about the age of twelve or fourteen months, until which time, in cases of Talipes varus, such mechanical apparatus should be used as tend to turn the toes outwardly, reducing the deformity to the condition of Talipes equinus; in the latter affection, whether primary or so reduced, depression of the heel may be judiciously attempted, which, if not wholly successful, will

at least prevent any increase of the deformity. If, by means of the operation and subsequent application of mechanical instruments, the reduction of the foot to a proper form be effected at the period when the child evinces a disposition to walk, he will rapidly acquire strength and activity. The act of walking will then to a great extent guard against the recurrence of the deformity, and the use of any mechanical apparatus may within a short time be discontinued. But the cure of infantile T. varus cannot be so easily effected, if, during the earliest months of life, the application of mechanical apparatus, calculated to maintain the toes in a straight line with the leg, by overcoming the twisting inwards and rotation of the foot, be neglected. The completion of the ossification of the external parts of the ankle and tarsus, the development of the internal malleolus and the neighbouring parts having suffered from the adduction of the foot, or the child having walked, by which the external parts of the tarsus have suffered from attrition, also add to the difficulties. Two or three months may consequently elapse before the child will tread equally, or the twisting inward of the member subside.

The plan I pursue in infants under the age of six months affected with T. varus is extremely simple, and which, with proper directions, can be partly entrusted to parents or assistants. It consists of the application of a smooth and narrow roller-bandage around the foot and leg, from the extremity of the toes to the knee, interposing along the inner margin and sole of the foot and the posterior and internal part of the leg a quantity of cotton wadding, to protect those parts from pressure; the limb should then be firmly and evenly bandaged in a tin splint, somewhat differently constructed to those usually employed, the entire attention of the surgeon being first directed to the removal of the inward tendency of the toes, and the reduction of the T. varus to the condition of T. equinus. The limb, when properly secured in this splint, is exposed to pressure in the direction the toes would maintain if held outwards with the hands in the position of T. equinus, the inside of the

metatarso-phalangeal articulation of the great toe and inside of the superior extremity of the tibia being the fixed points, towards which the bandage presses the ankle and tarsus, tending to overcome the unnatural curve presented by the deformed foot.

FIG. 24.—*Three of the series of tin splints recommended to be employed in certain cases of Talipes in infants.* No. 2 is adapted for the right foot, and No. 1 for the left, whilst the elevation of the heel continues considerable; No. 3 has the foot-part much inclined towards the leg, and is consequently fitted for a right foot far advanced in the process of cure. Between Nos. 2 and 3, four or five others, with the foot-parts at gradually increasing inclination towards the leg, are necessary to complete the series.

Much care is requisite in the application of the splint, as pressure in an improper direction might at this early period of the development of the tissues of the foot produce a permanent displacement or flattening of the bones of the tarsus. I have witnessed several cases of T. varus which had been for years under ill-directed mechanical treatment, and in which there existed secondary alterations of form, which I could only attribute to pressure improperly exercised at an early period. The back of the splint should be applied to the posterior part of the leg and foot, and the raised part should extend along the inside of the leg and inner margin of the foot. Should the splint have slipped around the leg, it must be immediately reapplied. The whole apparatus should also be removed on every occasion that the bandages become soiled by the infant, and immediately reapplied; for if the foot were permitted to remain a few hours without the restraint of the splint, more progress would during that period be lost than had been gained during its application for treble the length of time.

When either the great toe, the inside of the leg, or the

most convex part of the tarsus (the points more subjected to direct pressure) become chafed, the splint constructed for the left foot may for a day or two be applied to the right, during which temporary variation of the pressure, time will be allowed for the recovery of any part which may have suffered.

As soon as the contraction of the adductor muscles of the foot and the inward inclination of the toes is observed to be considerably diminished, and particularly if on the removal of the apparatus the toes are not immediately jerked or drawn inwardly, the splint may be advantageously exchanged for another the foot-part of which is bent more upwards. This should be applied in the same manner as the previous one, by which means we shall be enabled to maintain a constant stretching of the contracted gastrocnemii. Should these yield, the practitioner may resort to the employment of splints the foot-parts of which are bent to a still greater degree, until perfect flexion of the ankle is obtained.

On the infant attaining the age of six months, or if the treatment be postponed until this period, a more efficient instrument (see figs. 14 and 25) may be advantageously substituted. But as in the application of splints the rectification of the position of the foot must be attempted gradually, the foot-piece *a a* and *b*, fig. 14, and *a b*, fig. 25, must be screwed to such an angle with the perpendicular spring *c* as to correspond with the obtuseness of the angle which the foot forms with the leg.

One of the more prominent causes of failure in the treatment of club-foot, is the injudicious haste with which the rectification of the vicious position is frequently attempted, and the occurrence of abrasions of cuticle and displacement of the instruments. The abrasion results from excessive pressure and friction occasioned by the endeavours of the child to disengage the limb.

Success in the employment of any particular instrument is as much the result of the manner of application as of its peculiar efficiency. A few simple directions for the applica-

tion of that represented figs. 14 and 25, may not be inappropriate. A thick woollen stocking, or an elastic cotton bandage, should first be applied; if the foot is not well encased in adipose tissue, a portion of cotton wadding may be laid over the instep. The ankle-band *f*, detached from

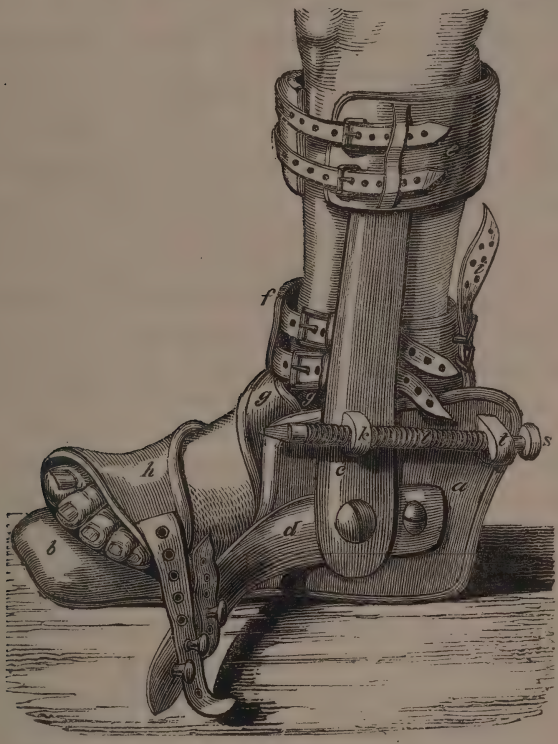


FIG. 25.—*The apparatus represented fig.* 14 *properly applied.*

the strap *i*, should be buckled around the leg above the malleoli; the surgeon, holding the shoe-part of the instrument in his left hand, should with his right place the heel in the shoe, and secure it by means of the straps *g g* firmly against the inside *a* (fig. 14). The heel should be prevented from rising by fastening the strap *i* to the back part of the ankle-band *f;* and the spring *c*, by means of the circular band *e*, formed of thin metal and properly padded, be applied on the outer side of the leg. This will effect a change in

the ankle-joint similar to that ensuing in the wrist when the hand is pronated. The inner margin of the foot being then directed to the ground, in opposition to the natural tendency of T. varus, the toes should be drawn as far outwardly as can be effected without pain by means of the padded strap *h* attached to the spring *d;* lastly, the ankle should be bent, by turning the screw *l*, with a key constructed for the purpose, as far as the tense tendo Achillis will permit. As long as the child is unable to walk, either by reason of its tender age or from the foot not being sufficiently bent, the screw *l* may be indented at its posterior extremity for the reception of the spring *m*, fig. 14, which prevents it turning in a retrograde direction; but if the child is able to walk, and the bending of the ankle advanced to nearly the right angle, the spring *m*, fig. 14, may be removed, and the extremity of the screw furnished with a small knob *s* fig. 25. As the screw *l* acts through the female screw *k*, which is fixed as a rotatory rivet upon the spring *c*, and *t* (fig. 25) is merely a stud through which the smooth part of the screw existing between the termination of the thread and the knob *s* can move freely forward and backward, a certain degree of motion of the ankle-joint is allowed in the act of walking, tending to increase its flexion, whilst the position of the screw *l* prevents the heel becoming elevated. If the spring *c* act in directing the inner margin of the foot to the ground too powerfully and painfully, a piece of tape, or a small strap, may be attached to the inside of the band *e* which is applied around the leg below the knee, and fastened to a buckle on the inside of the foot. This will moderate the action of the spring, which can be increased in the daytime, and diminished during the hours appropriated to rest.

Whether the cure be conducted either with or without an operation, it is of the utmost consequence to apply the necessary apparatus in such a manner that the repose of the child may not be disturbed, or uneasiness caused, so as to induce constant fretfulness, and interfere with its appetite and amusements. The welfare of a child so much depends on

the necessary quantity of sleep being obtained, that the practitioner should almost imperceptibly increase the action of the apparatus; and although restlessness may at first be produced, he will generally succeed in accustoming the child to its application. The cure of a Talipes would be dearly purchased at the sacrifice of general health; but the careful progress with the extension of the contracted parts, the removal of the apparatus once or twice daily, and the employment of friction with the liniment prescribed page 162, (which I have found to render the skin less prone to abrade), will uninterruptedly advance the restoration of the foot, provided it be curable without operation; if division of a tendon be required, they will ensure a speedy and perfect cure without the slightest derangement of the general health.

In many instances, after a considerable improvement in the form of the foot, through removal of the inward twisting and reduction of the deformity to T. equinus, attended probably by some depression of the heel, it will be found that the tension of the tendo Achillis is still very great. If the child be old enough to walk, I would recommend division of the tendon, which will in one or two weeks be followed by a complete cure of the deformity. The success of the operation is greatly assisted by the benefits already obtained from the apparatus; and the division of any other tendon than that of the gastrocnemii generally becomes unnecessary.

I am at present engaged in a series of trials of the utility of a mode of treating these distortions without operation, recommended by Cheselden. It consists in applying to the limb, whilst held in the straightest position of which it is susceptible, pieces of linen dipped in a mixture of white-of-eggs and flour or starch, which are in the restrained position of the limb permitted to become dry and harden. This constitutes the "immovable apparatus" of the present day. I have already employed plaster of Paris with a similar object, in the manner proposed by Dieffenbach. There are also some cases in which, after the operation of dividing the tendo Achillis or other tendons, the limb might probably be advantageously treated by means of the "immovable

apparatus." This has recently been suggested to me by Sir A. Cooper.

CASE XVIII.

TALIPES VARUS CONGENITUS.

Congenital club-foot in both extremities, from spastic contraction of the extensor and adductor muscles. Cure of the deformity of the right foot by division of the tendo Achillis, and of the left by division of the tendo Achillis and tendons of the anterior and posterior tibial muscles.

Nov. 12th, 1837. ****, aged nine years, a tall, stout, healthy boy, whose feet are at present distorted to the extent represented fig. 26, is stated to have been born with the most

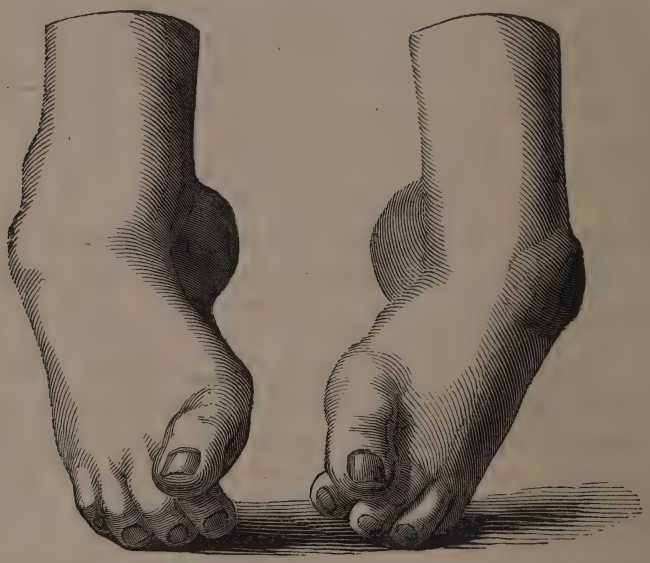


FIG. 26.—*Congenital Talipes varus affecting both feet.* This drawing is taken from the subject of Case XVIII., but serves to illustrate Cases XIX. and XX., as the greatest similarity existed in their external appearance.

severe form of club-foot, the toes having been twisted inwardly to a much greater extent. His favourite mode of

progression is on the knees, the integuments of which exhibit a considerable thickening, accompanied with an increased deposit of adipose tissue, resulting from attrition against the ground. In this unnatural mode of progression he has acquired great agility, and darts across the room, or scrambles up and down stairs, at a rapid rate. In consequence of the extreme contraction of the muscles of the posterior part of the leg, he is unable to walk without the application of very strong irons, secured around the hips, thighs, and knees; and even with this assistance the act of walking is laborious and unsightly. The right foot is less affected than the left, as it can be twisted somewhat farther outwards with the hands, and reduced to Talipes equinus, although it relapses to the more distorted condition on pressure with the hands being discontinued. The deformity of the left foot cannot be diminished in this manner, from the greater resistance of the anterior and posterior tibial muscles, and that offered by the form of the tarsal bones. If the patient were to persevere in the endeavour to walk, both feet would speedily relapse into the position presented at birth; as the toes would be forced inwardly, causing him to walk on the instep, similarly to the most severe gradation of T. varus (figs. 5, 6, and 32). The feet are much shorter, and proportionably broader, than in a natural state; the great toes are in a state of constant extension; the muscles of the leg wasted, and the entire length of the extremities strikingly deficient, compared with the trunk. The only remaining symptoms necessary to mention are the great degree of contraction of all the muscles of the sole, and the great stiffness of the ankle-joints, almost amounting to immobility.

Nov. 15th, 1837. Divided the tendo Achillis in both feet, and the tendons of the anterior and posterior tibial muscles of the left foot. The wounds healed prior to the fourth day, on which Stromeyer's foot-board, varied by the addition of a heel-piece and spring, represented figure 27, was applied to each foot. The process of extension was not so easy as in many of the preceding cases, owing to the rigidity of the

whole of the tissues, the degree of contraction of the muscles on the posterior surface of the leg which had not been divided

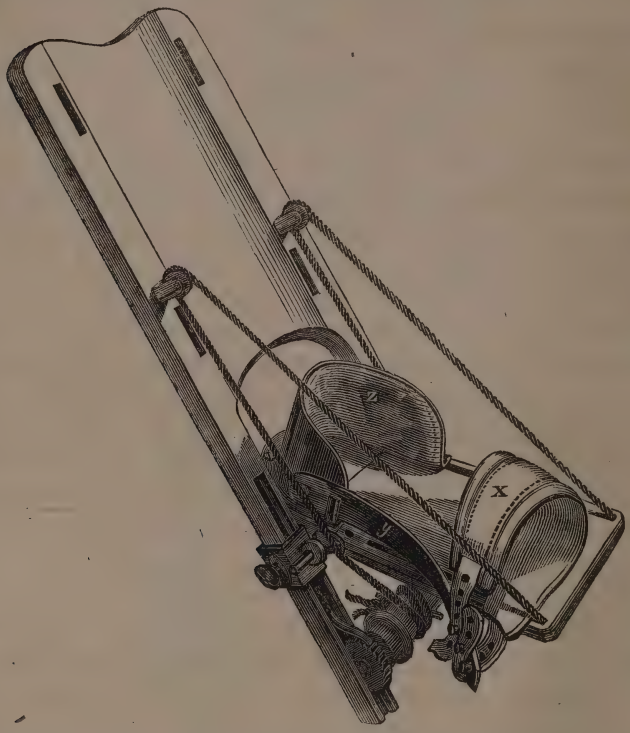


FIG. 27.— *The foot-board of Stromeyer, with some additions I have found useful during the treatment of T. varus.* It is constructed for the right foot. The letter *z* is a heel-piece, of brass or iron plate, of the form of a horse-shoe, well padded, and destined to receive the heel, and prevent displacement of the foot during the process of extension; *y* is a steel spring, to which a padded strap *x* is attached, by means of which the point of the foot may be drawn outwards. The remaining parts of the apparatus are the same as in fig. 13. The inner part of the heel-piece is longer than the outer, in order to afford a large surface, against which the heel should be firmly secured by one or more of the nearest straps (*m*, fig. 13) being passed through the inner fissures only (*i i i*, fig. 13), instead of through the fissures on both sides. The foot-piece of the apparatus is represented obliquely with the leg-part in both figures, to shew the manner of accommodating it to the obliquity of the sole.

at the operation, and of those of the soles of the feet. His

impatience whilst suffering from the irksomeness and pain of the extension, and the consequent disarrangement and loosening of the connecting straps of the apparatus, not only prevented a rapid progress, but caused a loss of time, requiring frequent readjustment of the foot-boards, and the occasional substitution of the instruments represented fig. 14; in fact, during the night he generally succeeded in completely disengaging his feet from the whole of the apparatus. I was consequently surprised to find the right foot, after three weeks' application of the apparatus, so greatly improved, that on standing erect in the instrument (fig. 14), the heel rested on the ground. The condition of the left foot was also considerably amended. During the succeeding three weeks the progress was uninterrupted, so that on Dec. 23d I was induced to permit his return home. The right heel and entire sole touched the ground; and on the instrument being removed, the foot evinced but little tendency to return to its former distorted state. The patient likewise walked on the heel and external part of the sole of the left foot, but the concavity of its inner margin was still considerable, partly in consequence of the form of the tarsal bones, and partly through the contraction of the muscles of the sole and the shortened state of the internal ligaments of the ankle-joint, which prevented the inner margin of the foot from being properly applied to the earth. It was an early period of the cure to allow of his return; but as the complete restoration of the form of the feet would necessarily be very gradual, and having been requested to perform the operation as auxiliary to a member of the family and of the profession, who had constantly had the case under his care, and the father, from the attention already devoted, appearing capable of superintending the daily application of the apparatus, I did not think myself justified in insisting on the patient's longer stay. His father promised that within two months the child should return, that I might be satisfied the case was proceeding favourably; but this promise has never been fulfilled. I have, however, been occasionally informed that the child continued to improve, and that the

favourable anticipations had been realised. Considering the unwillingness of this boy to submit to any inconvenience, and the necessity of the long-continued application of instruments in a case where all the muscles of the sole had been so greatly contracted, and the tarsal bones so much displaced, I doubt whether so perfect a cure has been obtained as might have resulted had he been longer retained under my care. The gratification of parents at the result of an operation, and the satisfaction of the practitioner, essentially differ. If the parents, after the application for some years of mechanical apparatus, witness from this operation a reduction to nearly the natural form within the space of a few weeks, they may be abundantly gratified at the result, and consider further treatment on the part of the practitioner unnecessary, and gradually cease the attention required to perfect the cure; whereas the practitioner is not satisfied with the result of an operation, provided the attainment of any portion of the benefit that may be derivable from it be neglected.

CASE XIX.

TALIPES VARUS CONGENITUS.

Congenital club-foot affecting both limbs from the same cause as Case XVIII. Cure by division of the Achilles tendons.

Sept. 6th, 1838. Miss ****, aged 21, born with club-foot of the highest degree. Her feet strikingly resemble those of the subject of Case XVIII., fig. 26, with the exception of the elevation of the left heel not being so considerable, and less inward twisting of the toes existing. The patient treads on the anterior part of the soles, and on that portion of the left foot corresponding to the inferior and external surfaces of the os cuboides. Neither foot can be improved in form by pressure with the hands; and considerable stiffness of the ankle-joint exists, amounting to "partial ankylosis." The deficiency in the length of the extremities, the wasting of the muscles, and the general rigidity of the tissues, per-

fectly correspond with the symptoms described in Case XVIII. To these may be added, diminution of the natural temperature, slight œdema, and a light purplish hue of the skin, indicative of injury to the innervation of the limbs.

Sept. 10th, 1838. Divided the tendo Achillis in both limbs. During the operation, the tendons were observed to possess an unusual degree of density, almost amounting to that of cartilage, having been severed with comparative difficulty. On the fourth day the foot-boards of Stromeyer were applied, after the cicatrisation of the punctures, and the extension was effected with the usual precautions. The resistance offered by the muscles on the back of the leg undivided at the operation, or by the ligaments of the joint, did not exceed the anticipations I had formed from the congenital nature of the distortion and the age of the patient.

After the first week of wearing the foot-boards, their application was discontinued during the night. The toes were gradually carried upwards; and within four weeks both heels were brought nearly to the ground, the extension having been daily continued, on the average, ten or twelve hours. The apparatus described in Case XII., page 146, was afterwards substituted, to enable the patient to walk, and thus facilitate the complete bending of the ankle-joints. The process of extension was attended with considerable œdema, and also with pain in the soles, against which the pressure of the apparatus was directed, and in the front and internal parts of the ankles (see "Remarks" appended to Case VI.). The patient endured this pain with the greatest perseverance, and walked resolutely for a quarter of each hour throughout the day. The heat and swelling, which greatly increased towards evening, were moderated by the use of spirit-lotion. At bed-time the apparatus was removed, tin splints being applied, the foot-parts of which were inclined to the leg at an angle corresponding to the daily advancing position of the feet. Through the relief afforded by this alteration the patient slept well, with the exception of one or two nights, and continued her usual diet,

not the slightest disturbance of the general health being produced.

At the expiration of the sixth week the bending of both feet exceeded the right angle, and it was considered advisable to limit the application of the extension-apparatus to three hours daily, during which she walked with a thick wedge of cork beneath the front part of the feet, to maintain them in the state of flexion. The tin splints were now discontinued at night, and the apparatus represented page 34 substituted, with the view of preventing any elevation of the heel, and of effecting that complete rotation of the foot on its antero-posterior axis which enables a patient, after division of the tendo Achillis, to tread as perfectly on the inner margin of the foot as on its outer margin. Two months after the operation she walked securely on the heel and entire sole of both feet, although, in consequence of the alteration in the form of the tarsal bones of the left foot, she was inclined to tread too much on the inferior surface of the os cuboides. The whole of the swelling and pain had subsided, and she was enabled to take occasional exercise in the open air. At this period the full extent of flexion had been obtained; the projections of the tarsal bones on the instep, more particularly the round head of the astragalus, and the troublesome corns which had invested the parts formerly subjected to undue friction and pressure, had entirely disappeared. The patient possessed the power of voluntarily moving the ankle-joints, but only to a limited extent, probably in consequence of the stiffness of the articulations, arising from the component parts not having been in proper apposition during their growth and ossification, and consequently being ill adapted to motion. Another cause of this rigidity of the joints appeared to exist — the contracted state of the anterior tibial muscles, the tendons of which were felt tense in front of the ankle-joint, when any attempt was made with the hand to press the toes downwards to restore the feet to their former distorted state; when the pressure was increased, these tendons could be perceived more powerfully acted on by the muscular fibres, as if excited to spasmodic action. The

daily use of a hot foot-bath, frequent frictions with an embrocation, and manipulations directed to the attainment of greater mobility of the joints, were now prescribed, the patient being enjoined to take exercise freely, and to dispense with the aid of sticks when the tender state of the articulations should subside. Lace-up boots were directed to be worn, stiffened on the inside with a thin steel spring between the lining and outer leather, for the purpose of supporting the ankle until the affected bones and muscles should become accommodated to the altered relation of the parts, and the occurrence of pain in walking should cease.

The report Dec. 29th, within sixteen weeks after division of the tendons, was, "the patient can stand for a considerable time without pain in either foot, or any sensation of fatigue; whereas, previously to the operation, the attempt to stand without resting one hand on a chair or table required a considerable effort. She walks with ease, placing the entire sole of each foot on the ground, and has likewise acquired much firmness of gait; but an appearance of slight lameness remains, from a want of elasticity, occasioned by the imperfect innervation of the gastrocnemii and stiffness of the ankle-joints, although the lameness is imperceptible on walking slowly, or availing herself of the assistance of the arm of a friend. After a long walk, some tenderness of the right ankle-joint (that in which the greater change has been effected by the operation) is still experienced, the elevation of the heel having been more considerable, and greater extension of the ligaments and other tissues surrounding the articulation having been necessary; but this tenderness will gradually subside. A diminution of the stiffness of the ankle-joints has already increased the power of alternately straightening and bending the foot."

CASE XX.

TALIPES VARUS ACQUISITUS.

Distortion of both feet, resembling in external appearance congenital club-foot, produced in the left foot by paralysis of the anterior muscles of the leg, and in the right by spasmodic contraction of the posterior muscles. The deformity cured by division of the Achilles tendons.

Miss ***, aged 11 years, is stated to have been seized with paralysis on the termination of an attack of fever at the age of three years. She continued helpless for a considerable period, and on the restoration of her health it was observed that she was unable to exert either lower extremity. Some months afterwards, on evincing a disposition again to walk, she was provided with "irons," which consisted of perpendicular bars of steel passing along the outside of the thighs and legs, fastened to the boots, and around the body by a circular padded belt of iron, and provided with joints opposite to the ankles, knees, and hips. The limbs have continued so weak, that until the present time she has been compelled to wear this cumbrous apparatus (answering to the purpose of a "go-cart"). Without this contrivance she is unable to make a single step; and even with its assistance the act of walking is extremely unsteady and fatiguing. The degree of elevation of the heels and inward twisting of the feet precisely resemble figure 26. The temperature of the feet is below the natural standard, and the toes are covered with the cicatrices of chilblains. The bones and muscles of the *right* leg are wasted, but she is able slightly to move the ankle-joint, in which act the anterior tibial muscle predominates over the peronei muscles; the foot is consequently not merely moved up and down in a straight line with the leg, but at the same time the inner edge of the foot is raised and the toes turned inwardly. The peronei are not paralysed, for these muscles direct its point outwards when the foot is extended. There is a total absence of volition in all the muscles of the *left* foot, as no voluntary movement of the joint can be produced, nor is the tendon of any muscle

rendered tense during the effort. The gastrocnemii are notwithstanding extremely contracted, and resist every manual attempt to elongate them with the view of bending the foot. The wasting of the bones and muscles of the *left* leg exceeds that of the *right*, the tibia and fibula being three and a half inches shorter than the corresponding bones of the *right* leg. The muscles of the thigh are weak, and the femur has likewise suffered a slight diminution in length.

May 21st, 1838. Divided the tendo Achillis in each leg; the punctures were permitted to heal, when the extension-apparatus (fig. 14) was applied.

The complete bending of both feet was accomplished within fourteen days, with the greatest facility and without pain. The application of the apparatus was uninterruptedly continued until the expiration of the fifth week, at which time the reunion of the divided tendons had acquired sufficient firmness to justify its discontinuance during the day. She was then allowed to walk in lace-up boots, stiffened on the inside of the ankle by a thin steel spring inserted between the lining and outer leather; that for the *left* foot being raised four inches from the ground by layers of cork continued along the entire length of the sole, in order to compensate for the deficiency in the length of the bones of this extremity. The application of the apparatus at night was now directed, but merely to retain the feet in their straight position. Her first attempts to walk, although awkward and laborious, were more successful than could have been anticipated from the weakness of the entire lower half of the body, caused by the original injury to the vegetative functions of the nervous system, without reference to the actual paralysis of the voluntary power of the *left* leg, and the spasmodic affection of the *right*. Precise directions were given respecting the manner of gradually exciting the debilitated muscles by exertion and practice. I particularly recommended the attempt to stand alternately on either leg (with or without the assistance of a stick or chair), the carrying a certain weight in one or both hands, to occupy in some definite action the muscles of the upper half of the

body, instead of permiting them to retain the shoulders and chest in the position formerly assumed owing to the deformity, together with frequent frictions and manipulations of the affected joints. A daily amendment was perceptible, and eleven weeks after the operation she walked a distance of two miles with comparatively slight fatigue. The previous languid condition of the circulation, and torpor of the functions of the alimentary canal, which appeared as much to result from the inactive life she had been compelled to lead as from the original injury in the centres of the nervous system, had suggested to me that great benefit would arise from a long course of the preparations of iron, combined with occasional gentle laxatives and a gradual augmentation of diet in proportion as the appetite improved. Under this plan, even during the necessary confinement to the house, considerable improvement of her general health ensued; but when enabled to take daily exercise in the open air, the progress in every respect was extremely rapid.

August 4th. "The paralysis of the anterior muscles of the *left* leg still continues, although the muscles of the thigh have improved both in strength and bulk; she treads firmly and uniformly on the entire sole of this foot; it would not be suspected that any paralysis existed, so completely is the place of the anterior tibial muscle supplied by the stiffening on the inside of the boot. She treads firmly with the *right* foot, but the preponderance of the action of the anterior tibial muscle over the peronei is perceptible by a slight turning inward of the toes, and a trifling elevation of the inner margin of the foot. The muscles of this leg and thigh have also considerably improved. Both feet have acquired an increase of temperature, from which it may be inferred that she will no longer be subject to the severe chilblains which formerly returned annually."

Remarks.—I have reserved the few observations relative to Cases XVIII. and XIX., in order to interweave with them those suggested by the peculiarities of this Case. One of the most interesting considerations, with reference to the

causes, both remote and proximate, of the deformity of Talipes, is the external resemblance which existed between these three cases. In Cases XVIII. and XIX. both feet were affected with congenital deformity, of spasmodic origin; in Case XX. the distortion of one foot likewise arose from spasm, but occurred subsequently to birth; the other was induced by paralysis. Cases XIX. and XX., notwithstanding the resemblance in external appearance, afford instances of T. varus varying in its nature in three respects:—first, congenital from spasmodic cause; secondly, non-congenital from the same cause; and, thirdly, non-congenital from paralysis. These varieties are reducible to two, there being no difference between the spasmodic case of Talipes varus whether occurring before or after birth, except with reference to its degree and duration. The congenital case is, *cæteris paribus*, worse than the non-congenital in proportion to the earliness of the period of uterine existence at which the disturbance of the nervous system takes place by means of which it is produced; for the less the bones of the leg and tarsus are advanced in development when the muscles of the limb become affected with spasm, the more complete is the Talipes varus. I have witnessed the distortion of Talipes in fœtuses expelled from the uterus at the period of three to four months of gestation; which corresponds with the time at which the muscles of the lower extremities of the fœtus acquire the power of moving the limbs, and consequently of producing Talipes when spasmodically contracted. The bones and ligaments of the tarsus are then so soft as to be incapable of offering the least resistance to the action of the muscles, and can be drawn into even unnatural positions, quite beyond the power of the muscles after the bones have attained perfect development. The majority of cases of Talipes which occur at a later period of utero-gestation, or after birth, are of a less degree of severity than that which characterises those occurring very early in uterine existence.

I have never witnessed congenital Talipes the origin of which could be traced to paralysis: one case only has occasioned me any doubt.

A few observations relative to the occurrence of the spasmodic form of Talipes in one foot, and its paralytic form in the other, are deferred until the "Remarks" on Cases XXIV. and XXXI.

CASE XXI.

TALIPES VARUS ACQUISITUS.

Non-congenital distortion (club-foot) from permanent spasmodic contraction of the extensors and adductors of the left foot. Similar aberration in certain muscles of the left arm. Cure of the deformity of the foot by division of the tendo Achillis.

Feb. 20, 1837. ****, aged 15, a boy of stunted growth and sickly appearance. His mother states that he had been a healthy child until the age of two years, when he was attacked with typhus fever, during the progress of which he had a fit in the night: this was "the crisis of the fever," as it then left him, but with the left arm and leg contracted. The consequent deformity of the foot has continually increased to the present time. He can scarcely make a single step without the assistance of a stick, from treading solely on that small part of the surface of the outer margin of the foot which covers the inferior extremity of the fifth metatarsal bone, as in fig. 9. If he attempt to rest his weight on the foot, the toes, metatarsus, and anterior bones of the tarsus (ossa cuneiformia, os cuboides, and os naviculare), are thrust so much inwardly and backward, that the foot touches the ground with the greater part of the outer side and the dorsum, as in fig. 11.*

* This drawing, to which a brief description is appended, although taken from another case, perfectly represents the deformity of the present subject. These two cases afford a striking illustration of the influence of permanent spasmodic contraction of muscles in producing distortion, and more fully exemplify the extent it may acquire than congenital cases of the same age; as the occurrence of the distortion after birth, its extent, and the accompanying general debility arising from the primary disease (fever), had rendered the act of walking impossible without the assistance of sticks or crutches. Little weight being consequently borne by the affected foot, neither unnaturally directed

The foot is extended to the greatest degree by contraction of the gastrocnemii, the heel remaining from the ground the entire length of the foot; consequently, when the metatarsus is held outwardly with the hands, it is in a direct line with the tibia. The heel cannot be forced downwards by the weight of the body; and the surgeon is unable in the slightest degree to press the toes in an upward direction. The great toe is shorter than the second toe, and is usually in an erect position; or, in consequence of its muscles being affected with involuntary contraction, it is alternately flexed and extended, the end of the foot possessing the usual truncated appearance of Talipes; the other toes are alternately greatly flexed or extended, although flexion preponderates. The dorsum of the foot is more convex from behind forwards than when in a healthy state. The entire foot is much shorter than the other, but the tibia is of the same length; the muscles of the thigh and leg, particularly those of the latter, are much wasted. He does not possess the power to bend the ankle, but can slightly raise the outer margin of the foot. He can voluntarily flex and extend the toes, although the flexor and extensor muscles are so imperfectly controlled, that various attempts to take a plaster of Paris model of the leg were frustrated by the tremor of the limb whilst the mass was hardening, induced by incompetent efforts to retain the leg in a tranquil state. The thigh is rotated outwardly, so that the internal malleolus presents almost directly forward, and the external malleolus backward in the same degree. He has also an analogous affection of the left arm and hand; the latissimus dorsi, probably assisted by the teres muscles, draw the arm both backward and downward; the pronator muscles retain the hand almost constantly in a prone state, the flexors of the wrist and fingers keeping the hand and fingers flexed: he is therefore deprived of the use of the limb, and unable to grasp any object, and can only bring the arm forward by moving

pressure, nor any friction of the dorsum pedis against the earth, could occur, by which secondary displacement of the bones, and increased deformity, might have been induced.

the scapula through the action of the proper muscles of that bone.*

26th, 1 P.M. Divided the tendo Achillis in the following manner. I placed the patient in a sitting position, and passed an ordinary sharp-pointed bistoury, narrow and slightly curved, from the inside of the leg above the tendon toward the skin of the opposite side, between the tendon, the deeper muscles, and the posterior tibial vessels and nerves, about the space of a finger's breadth above the malleolus. The two small incisions (for the point of the knife had perforated the skin of the opposite side, which never occurs when the plan described page 30 is followed, and not invariably even when the operation is performed in the manner here described,) were a little larger than the width of the bistoury, and were covered with adhesive plaster, and a circular bandage loosely applied.

10 P.M. He has been very restless, has often started, and has been occasionally slightly delirious. He possesses a very excitable temperament, and this unpleasant train of symptoms is attributable to want of attention to my injunctions of absolute quiet, his mother having had numerous visitors in the small room in which he lies. He has more frequent chorea-like convulsions of the arm than before the operation, and complains of slight pains shooting upwards from the divided part, with occasional catchings of the divided muscles. His bowels have been relieved since the morning; tongue clean; pulse but little quickened; skin not dry. Directed the removal of the candles and the visitors, and, provided he do not sleep within two hours, twenty drops of tincture of opium to be given, and repeated, if necessary, two hours later.

27th. Received an early message that he had slept well, and was in every respect comfortable: the opiate had not been required. On calling, I found him free from pain, and that he had felt a sensation as if "he could put the heel

* This non-congenital distortion of the hand constitutes, I presume, what is occasionally denominated scrag-hand; when it occurs prior to birth, it is named club-hand.

down." He stated that he was very well, and requested permission to rise. The foot is but loosely secured to the splint, and is not so completely extended as before the operation, being slightly drawn upwards by the action of the anterior muscles of the leg: the peronei have raised the outer margin of the foot. Ordered a mutton-chop and half a pint of porter daily: sulphate of quinine gr. i. thrice a-day in infusion of roses.

Second day. He slept well, and continues to feel very comfortable; he suffers no pain, although the anterior muscles of the leg somewhat disturb the divided parts by occasional startings. This action of the flexors only bends the foot to the extent of a few degrees. Pulse soft, although rather quick; tongue white, but no fur; little thirst; bowels not open to-day; appetite bad. Ordered the continuance of the mutton-chop and porter, with the addition of an egg or rice-pudding.

Third day. He remained much the same, perhaps rather better, for the twitchings of the arm and leg were less frequent. As the bowels were still confined, he was ordered to take early next morning a dose of castor-oil.

Fourth day. Removed the strip of adhesive plaster from the punctures; one was found closed, and the other nearly so. The perfect cicatrisation may have been retarded by the joint not having been left sufficiently at rest; but he is in every respect doing well.

Fifth day. Found both punctures closed. Applied Stromeyer's apparatus, although another day will elapse before any extension is attempted. Not wishing him to become prejudiced against the footboard before any actual extension was effected, I ordered tinct. of opium 15 drops, should its irksomeness keep him awake.

Sixth day. He is well and in excellent spirits, although it was found necessary to administer the opiate during the night. Re-applied Stromeyer's apparatus, with the parts so arranged as to maintain slight extension.

Twelfth day. He has continued improving in health; the convulsive actions of the arm are greatly subsiding, and

he can now slightly grasp objects. The foot is at a right angle with the leg. I have daily twice or thrice visited him, and at each visit slightly increased the tension of the apparatus : on complaining of pain from the pressure of the bandages, or apparatus, they have been loosened, and wadding interposed. A dose of tinct. opii has been ordered whenever he has complained at night of pain in the foot not appearing to originate from the pressure of any particular band. He was yesterday directed to endeavour to walk, wearing Stromeyer's apparatus. He is delighted with the sensation of treading on the sole, although it occasions pain in the front of the ankle-joint.

Twenty-sixth day. The foot is flexed to its utmost extent. I have allowed him to walk in a lace-up boot, having a rod of steel acting on the joint with a screw. He treads on the entire sole, or rather on the heel, as he is somewhat afraid to press on the sole from the remaining tenderness of the joint. The action of certain muscles, some of them formerly antagonised, is now apparent; for example, the ball of the great toe in walking is forcibly drawn against the ground by the action of the flexor longus pollicis and peroneus longus. During the wearing of the Stromeyerian apparatus, he complained of pain in the skin, &c. composing the ball of the great toe, shewing that those muscles had principally opposed the flexion of the ankle joint.

May 1st. He has visited me at my house. There is at present not the least deformity of the foot, and his gait is improved. He treads entirely on the sole and heel, and carries the point of the foot more straight.

He has since this period often walked with comfort eight or ten miles a-day.

Remarks.—A comparison of fig. 28 with fig. 11, which exhibits a degree of deformity perfectly resembled by this case, will demonstrate the effect of division of the tendo Achillis, and subsequent mechanical extension, in completely restoring the form of the limb. The cessation of the resistance of the gastrocnemii has been attended by a depression

of the heel to the necessary extent; and the combined results of turning the front part of the foot outwardly and bending

FIG. 28—*The foot of Case XXI. after the cure.*

the ankle have caused the entire investiture of the round head of the astragalus by the navicular bone, and the consequent disappearance of the former prominence on the instep. The great toe no longer stands erect, relaxation of its extensor muscles having ensued through the altered position of the foot. The inner malleolus, which was completely imbedded in the soft parts at the angle formed by the inner margin of the deformed foot with the tibia, is prominent in the restored foot; and the tarsus, instead of yielding outwardly, is rather inclined to project inwardly, from the tendency of the peronei muscles to raise the outer edge of the foot. An indication of the former existence of Talipes is perceived in the comparative shortness of the inner margin of the foot and great toe.

CASE XXII.

TALIPES VARUS ACQUISITUS.

Distortion resembling the highest grade of congenital club-foot, arising from non-congenital permanent extension of the ankle-joint; the remote cause being paralysis of the anterior muscles of the leg, and the proximate cause permanent contraction of the gastrocnemii and other posterior muscles from the absence of antagonists. Cured by division of the tendo Achillis only.

April 1st, 1837. **** ætat. 12, a boy with dark eyes, light hair, of slender frame, and apparently in delicate health. His mother states that he had been a healthy child, and that, until the age of four years, his legs were perfectly free from any affection whatever, the only ailment he had experienced being inflammation and suppuration of a lymphatic gland under the left angle of the jaw. (Tumefaction of these glands on both sides of the neck still exists). At the age of four years, he had an apparently mild attack of typhus fever, in which he lost the use of his limbs, which the attendant practitioner supposed to have taken place during a fit. He was carried about helpless for some months, but recovered the power of using his arms. Both legs at first appeared equally affected; but, on endeavouring to walk, he could only touch the ground with the toes of the right foot, the heel being drawn upwards. The deformity rapidly increased, the toes pointing inwardly; and at the expiration of fifteen months from the attack of fever, he was compelled to use a crutch, with the assistance of which he has since been unable to dispense.

The foot, viewed in front (see fig. 29), is observed to be doubled inwards, so as to form a right angle with the leg, pointing towards the left foot; owing to which, the great toe of the affected foot touches the inner malleolus of the sound limb. The whole of the sole, and the plantar surface of the toes, are turned directly upwards (see fig. 30); consequently, the entire dorsal surface of the foot touches the ground to the extent of its length. The instep and the back of the foot have completely reversed their relative positions

with the sole and heel (see figs. 29 and 30). On examination of the external aspect of the heel, it is observed to be not merely drawn up as high as in ordinary extension of the

FIG. 29.—*The front view of the Talipes varus acquisitus, affecting the right foot of the subject of Case XXII.*

FIG. 30.—*The same foot viewed from behind.*

ankle, to form an acute angle with the tibia and fibula, but it appears to be absolutely perpendicular behind those bones. The astragalus, instead of being normal or horizontal, is perfectly perpendicular, from the extreme contraction of the

gastrocnemii; the upper surface of its articular trochlea is therefore felt beneath the skin, extending forwards, whilst its round head rests on the ground. The anterior extremity of the os calcis, by which this bone should articulate with the os cuboides, likewise touches the ground. From the inward twisting of the foot, the surface of the os cuboides, which should appear upwards and outwards, and the proper dorsal surfaces of the third cuneiform, and of the third, fourth, and fifth metatarsal bones, are all applied to the earth, and thus receive, in their reversed position, the weight of the trunk alternately with the sound leg. There is sufficient motion in the tibio-astragalar articulation, and between the calcaneum and astragalus and the navicular and cuboid bones, to prove the non-existence of true ankylosis, and that the impediment to a reduction of the deformity must chiefly reside in the muscles and ligaments.

By attempting the restoration of the foot to its natural form by grasping the toes and the front of the foot with the right hand, and with the left the back part of the leg just above the malleoli, and thus endeavouring to carry outwards the front of the foot, twisting it so as to cause the sole to assume an inferior aspect, and the dorsum of the foot a superior aspect, the deformity was diminished to a certain extent; but the foot could only be reduced to the state of an aggravated Talipes equinus, the dorsum pedis still remaining extremely convex, the planta very concave, and the toes, from the action of their flexors, strongly incurvated, as is represented in the drawing of the dissected T. equinus, fig. 7. Ligamentous and tendinous bands, strong and tense, are felt passing from the os calcis to the great toe; the tendo Achillis is much stretched; the bones of the leg are shorter and more slender than those of the opposite extremity, and the muscles are much wasted; the thigh is also shorter, and its muscles are weaker. The patient does not possess voluntary power over any of the muscles of the ankle, although he can slightly move the toes.

April 4th. Divided the tendo Achillis (assisted by my friend Mr. Hamilton), in the same manner and situation as

in Case XXI., with similar dressing of the limb. Had I been disposed (as M. Bouvier first recommended), to operate in this instance by passing the knife between the skin and tendon, so as to divide the tendon from without inwards, or from behind forwards, the accomplishment of the operation might have been difficult, as the skin was very thin, transversely wrinkled, and firmly adherent to the tendon.

On the second day the minute puncture was cicatrised; and on the following day Stromeyer's foot-board was applied. The application of this excellent apparatus was attended with some difficulty, owing to the deformity exceeding in extent the degree which the instrument is adapted to relieve. The patient takes his usual diet.

7th day. The incurvation of the sole, depending on the contraction of the flexors of the toes, has decreased, and the point of the foot-board with the foot is beginning to rise above the windlass (*c*, fig. 13), by turning which the extension-cord is tightened. He has complained of uneasiness and pain in the bones of the foot, but not in the divided tendon. He wears the apparatus night and day. His sleep is occasionally disturbed; appetite good; bowels regular. Yesterday I ordered two glasses of wine daily. Tinct. opii, m. xv. every night. Spirit lotion to be constantly applied to the tarsus.

14th day. The foot has considerably advanced towards the proper position, the ankle-joint being at an angle of 130 degrees. He still suffers pain; and having continued restless during the nights, the instrument has been somewhat relaxed at bed-time, and he sleeps better. He has begun to walk with his foot remaining in the apparatus, thus assisting the bending of the ankle-joint; as its ligaments, having then to sustain the weight of the body, yield, and allow the os calcis to be borne to the ground. The apparatus is occasionally removed, and the foot bathed with the spirit lotion.

21st day. For the last three days, the foot has been at a right angle with the leg, the heel completely touching the ground (see fig. 31). He walks much about the room: all

pain has ceased in the ankle and tarsal joints, and is only produced when I attempt with my hand to force the toes more upward, or when I direct him, whilst standing erect, simultaneously to bend both the knee and ankle-joints. The epidermis is scaling off over the entire surface of the leg, the result of the œdema and congested state of the skin (almost undeserving the term slight erythematous inflammation), by which the limb had been for a few days affected from the constant pressure of the straps and bandages. His appetite has fallen off, and he appears somewhat harassed by the pain he has undergone. Ordered the discontinuance of the wine and tinct. opii, and to take quininæ sulph. gr. j. ex infus. rosæ ter die; also the discontinuance of the foot-board, and recommended him to wear the apparatus represented in fig. 14.

4th week. This apparatus he has constantly worn, which has proved of great assistance. His sleep is now quite undisturbed and his appetite restored.

5th week. He daily takes exercise out of doors with the aid of a stick, having laid aside the crutch. The whole of the sole and the heel now entirely touch the ground, and he is enabled to bear on the foot a great portion of the weight of his body.

6th week. His foot has this week been shewn to Sir A. Cooper, who expressed much surprise and pleasure on comparing it with the cast taken previously to the performance of the operation. He treads more freely and firmly, and in so doing experiences no pain. But if the point of the foot be unsupported by the instrument, and through its own weight be allowed to fall, he then feels some pain in the joint, owing to the inability of the tibialis anticus to retain it quiet in the flexed position. Ordered the foot to be well rubbed twice a-day with lin. saponis, and the joint to be freely moved in all directions.

7th week. This week he leaves his present abode, and returns to his home in a distant part of the metropolis. His health has greatly improved. Discontinued the quinine.

3d month. All tenderness has left the foot; he daily im-

proves in his gait, although it still continues awkward, from the shortness of the leg requiring a piece of cork of the

FIG. 31.—*The foot of the subject of Case XXII. viewed in front and somewhat from the inside, after the cure by division of the tendo Achillis.*

thickness of three inches along the sole of the shoe. His widowed mother is almost overcome with the fervour of her gratitude, on beholding the child whom for years she had been led to believe destined to the use of a crutch for life, a helpless cripple, now walking almost after the manner of other persons. In consequence of the continuance of the paralysis, much is still necessary (independently of the shortness of the leg, which is partly compensated by the raised shoe,) to enable me to compare this case, in every respect, with some of the cures effected by this operation, although it exceeded in deformity any that I have hitherto treated. His health has very much improved since the operation, as he is enabled to take the necessary exercise from which he had been so long debarred. The foot does not present the appearance of ever having been in the slightest degree deformed. (See fig. 31.)

Jan. 26th, 1838. He now walks very well, although still unable to dispense altogether with the stick, in consequence of the weakness of the muscles of the thigh and leg. His mother states that he stands a great deal, and that this morning he has walked above two miles to visit me: before

the operation, he had never left the street in which he had been brought up. He wears a common lace-up boot, with cork along the entire sole. He has hitherto obtained no power to exert the flexors or extensors of the ankle, although the joint is capable of being moved by the hand to its fullest extent. He can, however, very slightly abduct and adduct the foot, and he possesses motion of the toes. The thinness of the calf consequently continues, but the relative shortness of the leg has diminished since the operation, as the limb, having been brought into use, has equalled in growth the other extremity. During the state of inactivity in which the limb had been retained for eight years, and likewise from a concomitant injury of the organic system of nerves, its nutrition had suffered to the extent of diminishing its length more than three inches. It is highly probable that on attaining the age of twenty-one years, the difference in length would have exceeded four or five inches, which I have observed in instances of limbs similarly withered, the treatment of which had been neglected.

Remarks.—The extreme deformity of this foot almost irresistibly induced the opinion of the necessity of the division of the tendons of several of the contracted muscles, before even the possibility could be inferred of its reduction to a natural shape. The deformity was non-congenital, resulting from paralysis, and constituted that form of distortion, in the treatment of which greater reliance can be placed on the efficacy of mechanical extension than when the cause of the contraction is spasm. The patient's frame of body was of lax fibre, and I was satisfied that by far the greater portion of the muscular resistance was offered by the permanently shortened gastrocnemii, owing to their *comparatively* large mass, and the great distance of the tendo Achillis from the axis of the ankle-joint. The experience of what I had by perseverance previously effected in apparently hopeless cases, induced me, without hesitation, to undertake the treatment of this case by division of the tendo Achillis only; trusting by gradual extension to overcome the contraction of the

tibialis posticus and flexors of the phalanges, and to obtain the replacement of the bones of the tarsus by gradual stretching of the ligaments connecting their plantar surfaces, as well as of the contracted muscles of the sole, and the superficial ligamentum plantare.

The consideration of the present power of volition over the muscles of the leg affords some indication of the primary cause of the deformity, and confirms the diagnosis formed previously to the performance of the operation. From the observation of the peculiarities presented by this foot, and in which it differed from other Talipedes vari, I formed the opinion that the distortion depended on paralysis of the tibialis anticus, extensores longus and brevis digitorum, extensor proprius pollicis, and the peronei muscles. The accuracy of this opinion is demonstrated by the fact, that the deformity having been cured, with the complete restoration of the natural relations of the muscles and bones, he is still unable to bend or more than slightly abduct the foot. The power of moving the toes, which he still possesses, does not depend on action of their extensors, but on that of their flexors, and on the numerous small muscles of the sole. Had the muscles which are paralysed merely lost part of their power during the existence of the deformity by the elongation produced by permanent contraction of their opponents, (the muscles of the calf) they would have been enabled to raise and abduct the foot, after the opportunity of re-adapting themselves to their proper length by gradual re-contraction had been afforded them, through the power of the gastrocnemii having been removed by division of the tendo Achillis; inasmuch as a rapid recovery of muscular power takes place in the tibialis anticus, &c. after the cure of cases depending on a contrary primary cause, the spasmodic action of the gastrocnemii, or of cases where the deformity had been produced by abscesses and sloughing in the calf of the leg. (See Cases VII., X., XI., XII.)

Eighteen months after the cure of this case, I operated in one equally severe, likewise produced by paralysis, but of the left foot. The patient was a boy aged ten years, who,

during dentition, after having walked, had been attacked, without premonitory symptoms, with complete paralysis of both the upper and lower extremities. The paralysis of the arms and of the right leg subsided within the first year of the attack; but the left leg continued powerless, and contraction supervened, attended with deformity, which gradually increased until the foot resembled figs. 29 and 30. The restoration of the form of the foot was complete after division of the tendo Achillis and the application of mechanical apparatus, as in Case XXII.; the cure of the lameness has been even more successful, as the deficiency in the length of the extremity, from imperfect nutrition of the bones, only amounted to three-quarters of an inch.

These cases eminently illustrate the influence exercised by the act of walking in augmenting the distortion, when, antagonism of the muscles being destroyed, the ligaments alone remain to resist the operation of pressure improperly directed; and additional deformity ensues from this cause when the ligaments undergo a diminution of strength through participation of the vegetative functions of the limb in the injury of the nervous system. It appears probable that on the occurrence of paralysis of voluntary nerves, the nutrition of the part invariably suffers to a certain extent; but the degree of participation of the ganglionic functions of the limb may be proved in a variety of cases to differ, by the fact that where the number of muscles paralysed and the degree of paralysis is the same, the amount of atrophy of the limb and diminution in the length of the bones offer a very considerable discrepancy. In Case XXII. the diminution of the length of the entire extremity exceeded three inches; whilst in that above alluded to, it only amounted to three quarters of an inch.

CASE XXIII.

TALIPES VARUS CONGENITUS.

Congenital club-foot of the highest degree of deformity. Cured by division of the tendo Achillis and tendons of the anterior and posterior tibial muscles.

Mr. ****, a youth ætat. 17, a medical student, with large proportioned limbs, was born with club-foot of the right extremity, which, from the statement of his friends, was of the severest grade. The restoration of the foot was attempted during infancy, but unsuccessfully, by the medical attendant, by bandages, plasters, and splints; and subsequently by the application of "irons." The following was the condition of the foot when I first saw him, May 10th, 1837. Viewed in front (see fig. 32), it appeared exceedingly mis-shapen, the

Fig. 32.—*Adult Talipes varus congenitus of the right foot, Case XXIII.* The view is taken from the front, and somewhat from the outside. It represents the position in which the patient walked prior to the opera-

toes and front part having been so much twisted inwards, and the entire foot rotated to such an extent, that the dorsum touched the ground, the two larger toes only being fully visible. There were several inequalities of the tarsus, more particularly one, about the size and shape of a small orange, situated beneath the others, and resulting from pressure and friction of the tarsus against the earth. When seen from behind (see fig. 33), the inner margin of the foot and the heel

Fig. 33.—*T. varus cong. of the right foot, viewed from behind, Case XXIII.*

were observed to be completely raised from the ground, to which no part of the sole was applied, the three smaller toes

tion. The heel is elevated; but the inward inclination of the front part of the foot induces the appearance of its being simply rotated on its antero-posterior axis. The inequalities of the surface of the instep resulted from partial displacement of some of the tarsal bones, and the consequent denudation of the articular surfaces of others. The two tuberosities, the only parts in contact with the ground, are distinctly visible: the larger one, opposite to the articulation of the os calcis with the os cuboides; the smaller, opposite to the inferior extremity of the metatarsal bone of the third toe.

with their metatarsal bones being doubled inwards towards the ball of the great toe, which was attracted towards the heel, a deep groove extending horizontally along the entire sole. On attempting by means of the hands to reduce the foot to a proper form, the following difficulties were experienced: the tense tendo Achillis opposed the depression of the heel, and the tendons of the anterior and posterior tibial, with the extensor proprius pollicis muscles, and the long flexors of the toes, resisted the attempt to turn the foot outwardly; the whole of the muscles of the sole were also much contracted. But the chief impediments arose from the secondary alterations which had taken place from exercise of the limb in so distorted a position. The convexity of the tarsus, peculiar to T. varus, had been greatly augmented by the displacement of its several bones; and in addition to the callosity on which the patient had walked, which consisted of hypertrophy of the cutaneous and subjacent fibrous tissues, a considerable osseous deposit on the external surfaces at the junction of the os calcis with the os cuboides, and of the latter with the fifth metatarsal bone, appeared to exist. A reference to fig. 8, which represents the anatomy of T. varus of a somewhat less severe grade, will exhibit the nature of that portion of the displacement of the tarsal bones which is the result of inordinate action of the muscles. That produced by the action of walking may be understood by again referring to fig. 8, and conceiving the third, fourth, and fifth metatarsal bones to be thrust beneath the others, by which the superior surface of the os cuboides would become applied to the ground, as actually occurred in this case, visible in figs. 32 and 33.

No ankylosis of the articulation of the tibia and fibula with the astragalus, nor between the latter and the navicular bone, existed; a certain degree of motion was also felt between the os calcis and the os cuboides. His manner of walking was that peculiar to individuals affected with the most severe grade of club-foot. Independently of the local deformity, his general carriage was that of a person with a wooden leg, as the incapacity of the gastrocnemii occasioned a total absence

of elasticity, and reduced the limb to the condition of a mere passive organ of support. Indeed, its utility was actually inferior to that of a wooden leg, from the disadvantage of being extremely sensitive at those parts which came in contact with the ground; the protuberance opposite the junction of the os calcis with the os cuboides, and a large corn at the dorsal aspect of the inferior extremity of the metatarsal bone of the third toe, becoming inflamed and painful even after a short walk. From a very early period various descriptions of apparatus had been applied; and when placed under my care, he wore an "iron" of clumsy construction, but which in some degree served to support the foot and protect it from friction. The greatest distance he could walk was about a mile.

The complete involution or folding inwards of the sole is a remarkable feature of this case. The depth of the groove (resulting from the folded state) can be estimated by a reference to figure 33, and from the circumstance that the cutis, to the extent of a third of the sole (visible only when the folds were forcibly held asunder, as far as the distortion of the bones would admit), was covered with so delicate an epidermis, that it more resembled the epithelium of the mouth and lips. The contrast was still greater when compared with the ordinary thickness of the epidermis of the sole. It was evident that this part had never been in contact with the earth; and even doubtful whether it had been freely exposed to the air since the commencement of the act of walking.

May 19th, 1837. Divided the tendo Achillis and tendons of the tibialis anticus and tibialis posticus muscles, in the presence of several professional friends, among whom were Mr. Robert Davey, Mr. Kingdon, and Messrs. Hamilton and Adams, assistant-surgeons of the London Hospital. The punctures, three in number, completely cicatrised within forty-eight hours, when mechanical extension was commenced. The great extent of deformity rendered the adaptation of apparatus extremely difficult. The foot-board of Stromeyer, fig. 13, that represented fig. 27, the instru-

ments, figs. 14 and 25, and the splint, fig. 34, were resorted to, according to their respective applicability to obtain the results which were successively rendered necessary. The

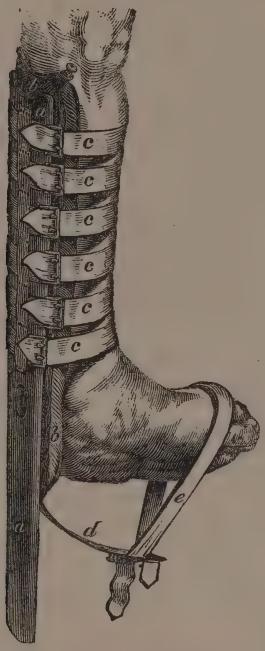


FIG. 34.—*Splint occasionally applicable in the reduction of the severest grade of T. varus.* The letters *a a* represent a strong wooden splint, having a circular hole at the part applied to the malleolus externus: *b b*, an india-rubber air-cushion, placed between the splint and the outer side of the leg. The straps with buckles marked *c* serve to secure the splint firmly against the limb; *d* is a steel spring, the power of which should depend on the strength of the ligaments and other tissues which it may be requisite to elongate; *e* is a padded strap passed around the front part of the foot, the lengthening or shortening of which diminishes or increases the traction exercised by the spring. The foot and leg should be bandaged, to prevent the occurrence of swelling. The successful employment of this splint, by overcoming the inward twisting of the foot, reduces Talipes varus to the more simple deformity of T. equinus.

turning outwards of the foot was accomplished by means of the splint and the apparatus fig. 14; the depression of the heel partly by the foot-board of Stromeyer, but more

by the apparatus fig. 14; which latter, when the foot was sufficiently twisted outwardly, better enabled the patient to take exercise. The unfolding of the foot was effected with difficulty, by spreading it on a piece of iron-plate covered with wadding, and securing it by a firm roller-bandage. This contrivance permitted the simultaneous application of apparatus to abduct the foot and bend the ankle. Considerable pain was at times produced, with occasional disturbance of rest. Within two months of the operation, nearly the whole of the inward twisting of the foot was removed, and the under surface of the heel touched the ground; but a great part of the incurvature of the sole and corresponding convexity of the instep remained. He trod on the heel, and the ball of the great toe and that of the little toe; the latter, however, experienced an undue degree of pressure, in consequence of the remaining incurvation of the sole, from the great degree of deformity which formerly existed. Such was the extreme thinness of the epidermis at this spot, that it was unable to withstand the effects of the pressure, and vesication was the result, followed by a slough of about the size of a shilling, which, on account of the strumous tendency of his constitution, occupied six months in the process of healing, although unattended with pain.

Throughout this period all mechanical apparatus was necessarily laid aside, from which great fears were entertained of the relapse of the foot to its distorted condition. It was placed on a pillow, in a position to facilitate the retention of the abduction, although the wound prevented the employment of any means to impede a return of the elevation of the heel. The process of cicatrisation having been so very tedious, he was permitted to take daily exercise in the open air with the assistance of sticks. On the healing of the wound, the realisation of part of the apprehensions previously entertained was apparent; the contraction in the lymph uniting the divided tendon had caused the recurrence of the elevation of the heel, although there was but a slight return of the inward twisting of the foot. It now became necessary to re-apply the mechanical extension, in order to

ascertain whether the contraction of the newly united tendon could be overcome, and the foot again be bent; but on every attempt the cicatrix became inflamed, indicating the probable occurrence of a breaking open of the wound, notwithstanding the introduction of an air-cushion, with a view to the equal distribution of the pressure over the entire sole. I therefore resolved on a re-division of the tendo Achillis, and contrived an apparatus for the accomplishment of the extension. The patient being in the erect posture, an exact impression of the sole, including the degree of elevation of the heel, was taken in plaster of Paris. The block of plaster had the oblong form of the sole, was of the thickness of four inches below the heel, and tapered off to the thickness of a quarter of an inch beneath the toes. As the foot exactly fitted into the impression made on its surface, the patient could bear the weight of the body on the limb without undue pressure being exercised on the cicatrix, or any particular part of the sole. A carver was then employed to make a perfect model in light wood of the plaster block, the accuracy of which was proved by applying it to the patient's foot, and causing him to stand erect. This wooden block was employed in a similar manner to the shoe-part (*a a* and *b*) of fig. 14, a perpendicular spring (*c*, fig. 14) being attached to its outer side; another spring, curved in the same direction, was also fixed to the inner side; appropriate straps were arranged to secure the foot, and the whole was enclosed in a common boot. The result of the application of this instrument answered my anticipations in every respect, as the patient was enabled to walk without pain in the tender part of the sole, although somewhat awkwardly, like a person wearing a high-heeled shoe. For several weeks prior to re-division of the tendo Achillis he was permitted to take free exercise, in order that the merits of this new apparatus for bending the foot might be fully tested, and to allow time for the perfect return to a normal state of the tissues surrounding the cicatrix which had been inflamed, after which they might reasonably be expected to resist the effects of any pressure to which, during the application of the apparatus, they might become subjected.

April 9th, 1838. Effected the re-division of the tendo Achillis with a small common scalpel. On the second day the wound was firmly healed, when the new apparatus was applied, and he was desired immediately to recommence taking exercise. The screw by which the bending of the joint was effected (constructed on a principle similar to *l*, fig. 14), was daily advanced; and at the same time a minute portion was rasped from the under surface of the wooden block, so as to admit the gradual descent of the heel, on the weight of the body being thrown on the limb. The progress was now most satisfactory; the advance of the screw, and the successive removal of portions of the infero-posterior part of the wooden block were so imperceptible, that not the slightest uneasiness was produced in the cicatrix, and in less than four weeks the heel touched the ground, the foot having been flexed to a right angle with the leg. This second bending of the foot, although accomplished in conjunction with daily exercise, was unattended with swelling of the ankle, or inflammation of any part of the divided tendon and the adjacent tissues. The application of the apparatus was continued for another month, to obviate the tendency to contraction in the lymph uniting the divided tendon, or to re-contraction of the muscles which had been elongated by mechanical extension.

June 2d, 1838. The report was as follows:—"Patient places the heel and sole on the ground (see fig. 35), resting the greater portion of his weight on the heel—tenderness where the slough existed preventing him from treading very firmly on the front part of the sole. No absolute deformity of the foot remains, although its proportions somewhat differ from those of one well formed. The thinness of the leg imparts to the foot the appearance of an unnatural length. The heel is likewise small, more particularly when contrasted with the great width across the toes. In the act of walking he is inclined to tread more on its outer than on the inner margin; and in consequence of a corn formed on the cicatrix of the slough, he is obliged to wear within his boot a cork-sole, perforated to prevent pressure on so tender a part."

He was by this time in a condition to visit his relatives in the country. Previously to his departure, I recommended

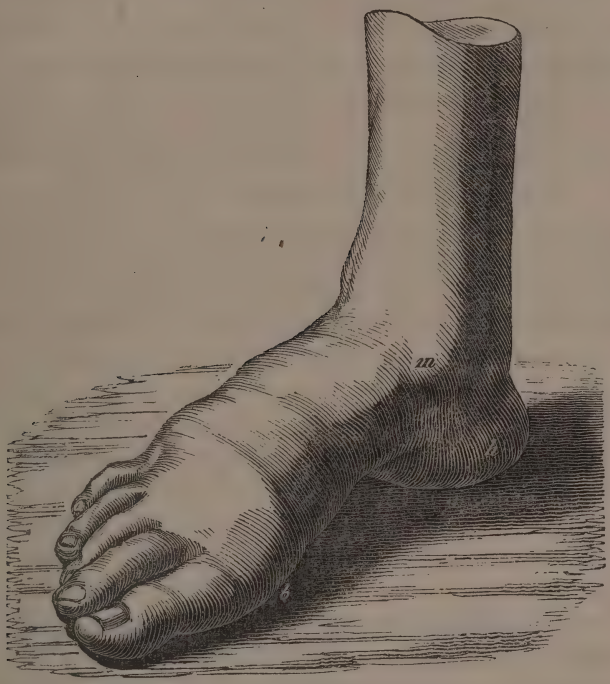


FIG. 35.—*View of the foot of Case XXIII., after the cure of the deformity.* (See figs. 32, 33).

a boot with two thin iron stems placed one on either side between the lining and outer leather, in order to support the ankle-joint, preclude the possibility of the slightest relapse, and obviate any injury that might result from incautious walking on rugged surfaces.

Sept. 1st, 1838. Considerable improvement of gait has taken place; he walks five or six miles with ease, and states that the alteration in his personal appearance has excited both astonishment and delight on the part of his relatives and friends.

Dec. 1838. He has considerable power in the muscles of the leg, as he can partially flex and extend the ankle-joint. The only lameness at present perceptible, and which is but

trifling, arises from the inability to bend the foot beyond a right angle. He is able to attend the whole of his duties as a medical student at one of the metropolitan hospitals. I have directed the removal of one of the iron stems, and anticipate, that at no very distant period, the other may with equal propriety be discontinued.

Remarks.—The length of time occupied in the cure of this case will not occasion surprise, when the extent of the deformity, and the numerous attendant difficulties, are considered. It may even appear remarkable that any relief could have been afforded to a deformity of so frightful an extent. The circumstances on which I founded my opinion of the propriety of attempting a cure were, the conviction that the contraction of the extensor* muscles on the posterior aspect of the leg, and that of the adductors, was the primary cause of the distortion (the deformity of the osseous structures being secondary), and the absence of ankylosis between the astragalus and tibia and fibula, between the former and the navicular bone, and between the calcaneum and cuboid. I was convinced of the absence of ankylosis by repeated examination, notwithstanding the great rigidity of the parts. I anticipated considerable difficulty in the replacement of the foot, from the osseous vegetations which were apparent on the dorsal surfaces of the os cuboides and the anterior portion of the os calcis, more particularly on the edges of these bones, which were in apposition. These anticipations were realised; as, notwithstanding the rapidity of the improvement during the few weeks succeeding the operation, both in the twisting outwardly and bending of the foot, the injury sustained by the articulation of the os calcis with the os cuboides prevented total replacement; for the two bones still formed a considerable angle, instead of being nearly in a straight line, as in the natural position. The inferior extremity of the fifth metatarsal bone was consequently brought in forcible contact with the shoe-part of the apparatus in the act of walking; hence the friction, vesication,

* Vide note, page 40.

and unexpected slough of the investing integuments. In a healthy constitution, the wound thus produced would have been of less importance; but so long a period was occupied in the cicatrisation, that elevation of the heel again ensued, rendering a second operation necessary. Such was the apparently hopeless state of this case when first presented to my notice, that doubts of the propriety of the operation were almost unanimously expressed by a large number of professional friends. Sir A. Cooper, who examined the foot both before and after the cure of the deformity, was highly gratified with the result.

Although so great an alteration in the form of a foot affected with this severe grade of Talipes varus may result from division of tendons and the application of mechanical apparatus, accompanied with reduction to a state of considerable utility, it must not be supposed that it will in all its relations bear a comparison with the condition of a sound foot. But the osseous fabric of the lower extremities may, on the whole, justly be considered of greater importance than the muscular system; for a person may walk with only trifling lameness when the muscles of the leg are in a state of complete atrophy; whereas a slight deviation in the form and position of the bones may render the act of walking painful and unsightly. The primary effect of the operation, and, in extremely severe cases, its principal benefit, is the restoration of the position and function of the bones. The pathology of the disease will prevent the expectation of the development and complete restoration of the function of the muscles, unless the cause resident in the nervous system which had distorted their equilibrium should previously have ceased to act. In this patient an improvement in the power of the muscles has resulted, as he can flex and extend the ankle-joint, and partially adduct and abduct the foot; but the muscles will never be sufficiently restored to render the limb other than an excellent passive organ of locomotion free from deformity.

CASE XXIV.

TALIPES VARUS ACQUISITUS OF THE LEFT SIDE, WITH PARALYSIS OF THE RIGHT.

Permanent spasmodic contraction of the gastrocnemii, tibialis anticus, and tibialis posticus muscles of the left leg. Partial paralysis of motion in the muscles of the right hip and thigh, with complete paralysis of those of the leg and foot. Division of the left tendo Achillis and tendons of the tibialis posticus and tibialis anticus muscles.

Mr. ****, ætat. 21, the son of a medical man, was born with a perfect state of the limbs, but "lost the use of both legs during the process of dentition;" the right having since continued powerless, and the left gradually become distorted, notwithstanding the restraint of various mechanical contrivances applied for the purpose of overcoming the unnatural action of the muscles.

March 27th, 1838. Present condition of the left foot:—The outer edge of the foot, and more particularly a prominence formed by the junction of the fifth metatarsal with the cuboid bone (*e* fig. 36), are applied to the ground; and when, in the act of walking, a further rotation of the dorsum of the foot towards the ground takes place, a process corresponding with the anterior extremity of the os calcis (fig. 36, *c*) receives the greater part of the weight of the body. The heel is elevated (see *d* in each drawing), through contraction of the gastrocnemii, although the spasmodic action of the anterior tibial muscle, by tending to bend the foot besides raising the inner margin, counteracts the elevation. The sole does not touch the earth, but presents vertically backward; and the dorsal surface of the tarsus and metatarsus, which should be superior, presents directly forwards. The toes are firmly flexed. The tendons of the gastrocnemii, tibialis anticus, tibialis posticus, and extensor proprius pollicis muscles, are tense and prominent (fig. 36, *a g f*), and constitute a portion of the obstacles to reduction of the foot to its proper form. The more serious impediments are, the displacement of the individual bones of the

tarsus (more particularly that of the astragalus, which is to a considerable extent rotated outwardly), and the deposition

Fig. 36.—*These three drawings represent different positions of the non-congenital club-foot, described Case XXIV.* That placed uppermost is a front view; the one on the left is a posterior view; and that on the right, the foot seen from behind. The letter *a*, in each drawing, indicates the tendon of the anterior tibial muscle; *b*, in the drawing on the right, shews the situation of the external malleolus; *c*, in the uppermost drawing, a process corresponding with the anterior extremity of the os calcis; *d*, in each, the heel raised from the ground; *e*, the posterior extremity of the fifth metatarsal bone; *f*, the tendo Achillis, passing in a curved direction to the posterior tuberosity of the os calcis, apparently deviating inwardly,* but actually having its insertion nearer to the external malleolus than in a sound limb; *g*, in the left drawing, the outline of the tendon of the posterior tibial muscle.

of osseous matter which has taken place at the junction of the os cuboides with the os calcis, through the unnatural mode of progression. The temperature of the feet is below the natural standard, and the muscles are much wasted; but

* The heel and tendo Achillis are generally described as being twisted inwardly in Talipes varus; it will nevertheless be found, that although the tendo Achillis passes in a curve towards its insertion, the convexity of the curve

the left thigh is larger than the right. The legs are of equal length. The patient walks with great difficulty, requiring the assistance of sticks, and suffers considerable pain from inflammation of that part of the outer margin and dorsal surface of the foot on which he treads. He endures much toil and fatigue, which arise equally from paralysis of the right limb and the contraction of the left.

March 29th, 1838. Divided the tendo Achillis and tendons of the tibialis posticus and tibialis anticus muscles. The punctures united favourably, so that on the third day after the operation the apparatus represented fig. 14 was applied, to endeavour to replace the foot. The extension during the first few days effected a considerable improvement, after which the progress was slower; but it proceeded as rapidly as I had anticipated; for at the expiration of one month, the under surface of the heel, and that of the outer two-thirds of the sole, were applied to the ground, the rotation of the foot being almost entirely overcome. The ball of the great toe was brought to within a quarter or three-eighths of an inch of the ground; and the slightest pressure on the metatarsal bone of the great toe sufficed to bring it in contact; but the permanent and total disappearance of deformity was prevented by the osseous deposit on the external surface of the os cuboides and os calcis, which impeded the mutual yielding of these bones. He could nevertheless bear the weight of the body firmly on the limb even without the apparatus, although with its assistance the act of walking was more secure. Instead of each step producing pain, and great fatigue being endured on walking two or three hundred yards, he was enabled to walk the

being directed to the fibula, its course, and the posterior extremity of the heel, are actually nearer to the external malleolus than in the natural relation of these parts. The curve formed by the tendon is probably caused by the rotation of the foot on its antero-posterior axis; the approximation of the posterior extremity of the heel to the external malleolus results from the navicular bone being drawn by the anterior tibial muscle towards the internal malleolus, and the consequent adduction of the foot. The adduction being effected by a horizontal rotation of the astragalus, the posterior extremity of the tarsus, formed by the os calcis, is thrown outwardly, in proportion as the front part of the tarsus and foot are drawn inwardly.

distance of a mile without suffering, and with comparatively trifling exertion. I strongly urged the application of the apparatus with the springs and straps so adjusted as to act powerfully on the remaining displacement of the tarsal bones; but in consequence of the occurrence of pain he was exceedingly averse to further endeavours to improve the foot, and preferred sacrificing the prospect of greater ultimate benefit to the present gratification of taking exercise free from uneasiness. Two months after the operation he went into the country, and did not revisit me for several months. The position of the foot had not undergone any amendment since his departure, having, from a severe illness, experienced long interruptions in wearing the apparatus; he had, however, improved in walking, stating that although his pace was slow, he could with greater facility walk four miles than perform, previously to the operation, his ordinary avocations within doors.

Remarks.—This case is particularly interesting, from the primary disturbance in the nervous system having been evinced by paralysis in the right limb, and spasmodic contraction in the left—from the paralytic affection not having been succeeded by any distortion—and from the decided influence exercised by the anterior tibial muscle in the production of the deformity of the spasmodically contracted limb. Its non-congenital nature seemed advantageously to illustrate the manner in which severe congenital Talipes varus is produced. From the pathology of spasmodic diseases, it may be inferred that a higher degree of injury to the delicate fabric of the medulla spinalis is required to produce paralysis of muscles than spasm. The co-existence of paralysis of the right limb and spasm of the left therefore indicates that the primary lesion was greater on one side of the medulla; we may also infer, from the knowledge that paralysis results from disease on the side of the spinal marrow opposed to that affected, and the right limb having been paralysed, that the left side of the spinal marrow suffered more severely. The nature of the lesion on both sides of the medulla was probably inflam-

matory; and it may justly be assumed that on the right side the lesion of the capillaries, the seat of the inflammatory process, amounted only to a weakening or relaxation, through which the extremities of the involuntary motor filaments of nerves (reflex) distributed to the affected muscles of the left leg were irritated (excited) so as to induce spastic contraction of their fibres, but that it was sufficiently severe to become permanent (constituting permanent congestion); hence the persistence of the spasm. On the left side, the lesion of the capillaries reached a more advanced stage of inflammation; it was not arrested either at the stage of relaxation or at that of permanent congestion, but was probably accompanied with effusion into the delicate tissue of the part, which has never been absorbed; or the inflammation may have terminated in ramolissement or complete destruction of the tissue involved, either of which results are sufficient to account for the permanency of the paralysis.

An observation of the father of the patient, that when "the use of the limbs was lost," he perceived no difference in the affection of either limb—that both appeared equally affected with paralysis—is worthy of notice. In accordance with the distinction which I have made between the state of the central organ in paralysis and spasm, we may perhaps from this observation conjecture that both sides of the spinal cord were originally equally affected, but that subsequently the effusion on the right side was removed, the slighter affection of the nervous tissue (congestion) alone remaining. Hence the removal of the paralysis and occurrence of the spasm.*

* In order to test the accuracy of this opinion, we can scarcely deduce that, if correct, paralysis, when gradual in its occurrence, should invariably be preceded by spasm; for although relaxation of capillaries in a particular spot of the central organ is adduced as the probable cause of spasm, it does not follow that spasm should necessarily result from such relaxation, as it may be regarded as one consequence only of that morbid change. Even the assertion, that the morbid change in the nervous tissue which induces the perplexing phenomena of the spasmodic diseases in general depends on relaxation of the capillaries, is an assumption founded only on our ignorance of any other cause than inflammation capable of producing the effects we witness, and on the opinion that relaxation is the *sine quâ non* physical change which takes place in the capillaries during that process.

The circumstance of the paralysis not being followed by distortion is deserving of inquiry, from the contrast afforded by the cases of this affection already related in which deformity ensued (Cases I., III., IV., XX., XXII.). These were examples of paralysis of volition in certain muscles on the anterior aspect of the limb; the involuntary contractility of the muscles on the posterior part being released from the antagonist power exercised by the will, and gradually contracting, distorted the limb, and thus produced Talipes. In Case XXIV. the whole of the muscles of the right leg were totally paralysed; not with reference to volition alone, for the involuntary motor contractility appeared deficient, indicating that the filaments of volition and the organic motor nerves, with those appertaining to the reflex functions of the muscles (if such separate filaments exist), were involved in the primary disease, and consequently that no contraction and deformity could possibly take place. A careful investigation of the state of the various muscles in Case XXIV., and similar ones which I have had the opportunity of examining, has induced me to offer this explanation of distortion occasionally accompanying paralysis, and being at other times absent. But I must direct attention to another species of paralysis accompanied with distortion, respecting which it is doubtful whether volition had not been simultaneously suspended in the flexors and extensors, but in which contraction had nevertheless resulted; not the slightest traces of volition could be detected in any of the muscles of the leg; whence it would appear that the primary disturbance in the nervous system had affected either the origin or course of the filaments of volition, and left intact those on which the involuntary motor contractility depends, by which the posterior muscles of the leg, constituting the larger mass of muscular fibre, had obtained the ascendancy, and thus distorted the limb.

Dr. Stromeyer has stated that spasmodic contraction of the anterior tibial muscle could not conjointly exist with that of the gastrocnemii, from the notion that the office of the former being to bend the foot, and the latter to extend it, their conjoint spasmodic action would be neutralised. This

might result if the action of the anterior tibial muscle were simply to bend the foot; but it is also an adductor, elevating the inner margin of the foot and turning it inwardly. The posterior tibial muscle is associated with the anterior tibial in some of its functions; and in accordance with the pathological law which I have already demonstrated,* — namely, that muscles associated in their physiological actions are liable equally to participate in spasmodic affection,—contraction of these two muscles is witnessed in T. varus. In the analogous affection of the hand (club-hand), the pronators and the flexors are affected in common; but the extensors are neither affected conjointly with the pronators, nor the flexors with the supinators. I have mentioned, page 40, that the muscles on the posterior aspect of the leg, called extensors, because they straighten the foot by elevating the heel, are by analogy flexors, as they correspond with the flexors of the hand by their relative position on the bones, and by the similar vessels and nerves distributed to them. The difference which exists arises from the peculiar arrangement of the ankle-joint. Conformably to this analogy and the pathological law just alluded to, we should *à priori* expect that the anterior and posterior tibial muscles might be concurrently affected with the gastrocnemii. And such is the fact; for although the gastrocnemii may be alone contracted, producing Talipes equinus, yet whenever Talipes varus results, both adductors of the foot (the tibialis anticus and tibialis posticus) are affected simultaneously with the gastrocnemii.

The circumstance, that in Talipes varus the inner margin of the foot forms a right angle, or even an acute one, with the leg (figs. 5 and 6), the front part of the foot appearing to be bent inwardly and upwards, might mislead as to the existence of contraction of the gastrocnemii; but an examination of the fibular aspect of the most distorted congenital case will indicate that the os calcis is almost perpendicularly elevated behind the tibia and fibula. It may indeed be asserted that the extraordinary form of the foot affected

* See "Symbolæ ad Talipedem Varum cognoscendum," previously quoted.

with severe congenital T. varus being irreconcilable with any natural position, is the reason that mechanical injury in the womb has been resorted to for the explanation of the production of the deformity. This opinion is at once untenable, when we rationally construe the pathological facts adduced throughout this treatise. The explanation of the peculiar form of the foot in the severest form of T. varus is, that the tarsus, being subjected at its extremities to two opposing forces, is forced to yield in the middle. Posteriorly, the os calcis is elevated by the action of the gastrocnemii: anteriorly, the navicular bone, together with the cuboides and cuneiform bones, and consequently the metatarsus and toes, are drawn upwards and inwards by the action of the anterior and posterior tibial muscles. The yielding in the tarsus takes place between the navicular and astragalus, and between the cuboid bone and the calcaneum, and is commensurate, *cæteris paribus*, to the earliness of the period of existence at which it takes place. Thus, when the disturbance of the muscles occurs before birth, the connexion between the tarsal bones being slender, and the bones themselves incompletely developed, the yielding of the tarsus may reach an extraordinary extent; whereas, if the spasm of the muscles takes place after birth, the muscles are seldom able to effect so great a distortion; although, when paralysis has been the disturbing cause of the equilibrium, and the nutrition and consequent firmness of all the tissues more impaired, the deformity readily attains the highest grade. Its increase may likewise, as already so fully explained, be accelerated by the action of walking.

CASE XXV.

TALIPES VARUS ACQUISITUS (HYSTERICUS).*

Non-congenital distortion (club-foot) of the right side, from spasmodic contraction of the anterior and posterior tibial muscles, the gastrocnemii and flexors of the toes, in conjunction with numerous symptoms of hysteria. The distortion cured by the administration of sesquicarbonate of iron.

****, æt. 19, a young woman apparently of a nervous temperament, admitted into the London Hospital August 1837, stated that until within the last two years she had enjoyed excellent health, although she had only twice menstruated, namely, at the age of thirteen and fifteen. About two years since, she experienced a severe fright, which was succeeded by violent pain in the head and left side, with irritability of the stomach; after this she frequently vomited a large quantity of blood, which usually took place before seven in the morning, and in the evening, during nine or ten days, and occasionally lasted for a month; the quantity of blood discharged greatly exceeding that of ordinary menstruation. These symptoms were treated by frequent venesections and blisters. Within a month of the commencement of her illness she was attacked for several successive days with fits, termed by her medical attendants convulsive, during which she was insensible; these occasionally recurred during the ensuing three months. An inability to void the urine was the next symptom, for which the medical attendant resorted to the catheter. She never recovered the power of expelling the contents of the bladder, and was accustomed herself to employ the instrument. Although the catamenia were absent, she had every four or five weeks a periodical discharge of blood, either from the stomach, the nipples, the skin of the mammæ, and even from spots of the size of a crown-piece on the skin of the forearm. It is probable that the whole of these spots had been vesications, succeeded by ulcerations. For several months she was unable to open her mouth, the consequence of a fall

* For the early history of this case I am indebted to Mr. John Adams, assistant-surgeon to the London Hospital.

down stairs, preceded by giddiness, and accompanied with complete loss of voice for the first ten weeks. For a month she had a contraction in the right hand, the thumb and fingers having been firmly clenched; this was cured by being bandaged to a splint, and by a succession of blisters to the arm. She has passed small calculi per urethram. The bowels have been much disposed to constipation, for which powerful purgatives have been administered; and she complains of a cough of twelve months' duration.

On admission, her ailments were augmented by pyrosis, anorexia, pain in the loins, hypogastrium, and left side, oppression at the præcordia, globus hystericus, hot and painful state of the mammæ, with a rigidity of the muscles of the leg, and imperfect use of the member. Her general health was greatly improved by the treatment pursued by Dr. Frampton, and, ten weeks after admission, she was transferred to the surgeons' wards for the contracture of the foot, which, five weeks previously, had been aggravated by another fall down stairs, and had become firmly twisted upwards and inwards, so that she could not restore it to the natural position. Mr. Andrews prescribed the mist. ferri comp. ter quotidie, and requested me to examine the limb, to assist in determining the means to be resorted to for the cure of the distortion. At this period, Dec. 28th, the appearance of the foot exactly resembled fig. 36, its outer margin alone touching the ground, the sole presenting vertically backwards, the tibialis anticus, tibialis posticus, and gastrocnemii tendons being tense from contraction of their respective muscles, and the toes firmly incurvated; she was unable to rest on the limb, the attempt being followed by an outward yielding of the tarsus, which brought the superior surface of the os cuboides in contact with the ground. Locomotion could only be effected with the assistance of crutches. Some difficulty was experienced in ascertaining the precise time the contraction in the leg had existed; for amongst the multitude of symptoms and the various periods at which they had occurred, combined with the nervousness peculiar to her condition, she was quite confused in the dates, but positive

that she had not walked for at least a year, during which the foot had never been in its natural position. The trismus continued; and the patient complained of being unable to take solid food, although the teeth at times became more widely separated. The nurse stated that she had never seen her eat any thing solid. Many hysterical symptoms remained, although, after being transferred to the surgeons' wards, she had once menstruated naturally for two days. The propriety of dividing the tendons of the contracted muscles was considered in consultation, but the following prescription was resolved on :—

℞ Ferri Sesquicarbonatis ʒss.
Sodæ Sesquicarb. gr. v.
M. ft. pulvis, ter die sumendus.
Full diet, with half-pint of porter daily.

Stromeyer's foot-board was also applied, to endeavour to restore the foot to its proper position. The dresser was requested occasionally to separate the maxillæ to the fullest extent, and, as the muscles of the tongue and fauces were unaffected, to convince her of the possibility of taking solid food.

The report Jan. 3, 1838, was, "she has experienced pain in the spasmodically affected muscles, from their having been elongated; she has also complained of the pressure of the straps and bandages of the apparatus, and is unwilling that its application be continued; in compliance with which, and in order to observe the effect of the medicines without mechanical treatment, it has been removed, and the dose of sesquicarbonas ferri increased to one drachm."

"Jan. 24th. During the last few days the spasm has been gradually relaxing, the foot being much less distorted, and easily reducible to a proper position. She can likewise depress the inferior maxilla to a greater extent, and take animal food. Her general health is improving; the bowels continue disposed to constipation, but less so than formerly. She still appears unable to place the foot flat on the ground, and complains of its extreme weakness. In order to exercise the limb, she is recommended to commence walking, with

the assistance of crutches, in the ward and garden of the hospital.

℞ Pilulæ Aloës Comp. gr. x
Fiant Pilulæ ij. alternâ quâque nocte sumendæ.
Continuantur pulveres.

Feb. 15th. States that she is altogether better, although the foot continues weak, and that she is unable voluntarily to bend it. It is, however, flexible with the hand in every natural direction; but a degree of stiffness in the articulation remains. Ordered daily frictions and manipulations of the limb in addition to the medicines, and the application of the foot-board when not taking exercise, to retain the foot in the bent position, and thus afford the anterior muscles of the leg, which have been debilitated by long-continued spasmodic action of their antagonists, the opportunity of gradually recovering their tone.

Feb. 26th. Rigidity of the posterior muscles of the leg having entirely ceased, the application of the foot-board occasioned no uneasiness, as the muscles of the limb were not disposed to displace it. She walks without lameness, a degree of stiffness alone remaining, which she attributes to its comparative weakness. She does not appear to exert the muscles in walking; yet the increase in the circumference of the limb indicates that they are regaining strength. The peronei and anterior tibial muscles appearing to require some slight mechanical assistance, and it being necessary to impart confidence in her ability to walk a considerable distance, a lace-up boot, having a small spring inserted between the lining and outer leather, has been ordered. Recommended the continuance of the ferri sesquicarb. for a few weeks longer, to prevent relapse."

She was discharged March 1838, being able to walk well either with or without the boot.

An opportunity of examining this patient was afforded me July 26th. She was perfectly free from distortion and lameness, but declared that she could not exert the anterior tibial and peronei muscles, though it was evident that the

action of the muscles was in no degree paralysed; for when, during manipulation of the foot, her attention was not directed to this matter, they were distinctly observed to contract. Her general health appeared greatly improved; the amenorrhœa, however, continued, but periodical epistaxis had taken the place of the hæmatemesis.

Remarks.—The question of the propriety of dividing the tendons of the contracted muscles was entertained from the circumstance that the foot, on being forcibly twisted with the hands into its natural position, was violently and immediately drawn into the deformed state—demonstrating that spasmodic muscular contraction was the sole cause of the distortion. The adoption of a radical and speedy cure was desirable on account of the aggravation of the general symptoms produced by confinement and the want of proper exercise; the danger of secondary injury to the articular surfaces of the bones and other tissues of the foot, resulting from the long-continued improper position of the limb; and from the certainty that, after the performance of the operation, and reunion of the divided tendons, she would be able freely to exercise the limb and support on it the weight of the body. But the possibility of sudden cessation of the spasmodic state of the muscles, an occurrence so common in some hysterical affections (occasioned, perhaps, by the lesion in the nervous system on which it depends being of a functional, rather than of an organic nature),—the uncertainty whether the peculiar disposition of the mind in hysteria would permit the patient after the operation to exert herself for the perfection of the cure, by employing whatever voluntary power might be possessed over the limb,—and my experience of the removal of distortions, produced in a similar manner, by long-continued administration of sesquicarbonate of iron,—induced me to recommend this remedy, in conjunction with the application of Stromeyer's foot-board; and in the event of the failure of this plan, division of the tendons to be resorted to. The result justified my anticipations: the spasm of the muscles of the leg (and of those belonging to the maxilla), having

gradually subsided as the sesquicarbonate of iron, aided by an increased quantity of food, improved the condition of her nervous system.

I have witnessed, in consultation, a similar case of a few months' duration (likewise an hysterical subject), wherein contraction of the right anterior tibial muscle had been erroneously considered the sole cause of the distortion, and for the cure of which its tendon had been divided. I found that contraction of the posterior tibial muscle was the cause of the continuance of deformity; and as the method of cure by operation was already resolved on, I pointed out the influence exercised by this muscle, and recommended its division, which was immediately performed in the manner previously described. The deformity was instantly and completely removed; an apparatus was applied to retain the foot in a proper position; and in a short time the patient regained the use of the limb. This case was favourable for a trial of the means of relief within the limits of medicine, and the operation might have been judiciously postponed; but such was the efficacy of the treatment, and so little pain and loss of time being experienced, that the patient might with justice congratulate herself on the adoption of the operative method, more particularly as the medical plan might have failed. Notwithstanding my belief that the operation of dividing tendons may be equally safe in hysteric Talipes as experience proves it to be in the other forms, I think it should invariably be deferred until more simple means have been unsuccessfully tried, and until the lesion in the nervous system may be supposed to have lost the transient character frequently peculiar to hysteric affections, and the existence of structural shortening, together with the spasmodic contraction of the affected muscles, diminishes the hope of cure without the aid of surgery. The observations contained page 26 are particularly applicable in the treatment of distortions in hysterical persons.

A third case of hysterical contracture has recently fallen under my notice. The patient, aged 23, was affected with pain in the stomach, obstinate vomiting of food, occasional

hæmatemesis and constipation, with general debility. For twelve months past she had perceived a stiffness of the left knee, which had gradually increased; and at my first examination was unable perfectly to straighten it, from "tightness of the ham-strings," as she termed the affection, but which was evidently a gradual increase in the involuntary contractile power of the biceps femoris, semi-tendinosus, and semi-membranosus muscles. Its origin was coeval with the general debility (see page 104). This patient is also recovering under a carefully regulated diet, active exercise, and the administration of ferri sesquicarb. and pulv. cubebæ, the latter of which has remedied the constipation.

CASE XXVI.

TALIPES VARUS ACQUISITUS.

Temporary distortion of the right foot, from spasm of the gastrocnemii and posterior tibial muscles, occurring during an attack of spasmodic croup, combined with a similar affection of both hands. Cured without operation.

March 1st, 1838. ****, a boy, nine years of age, of fair complexion, dark hair and eyes, cheerful and intelligent. I was summoned in haste at 10 A.M., and informed that the patient had suffered from cough for a few weeks, which had suddenly become worse the previous evening, and assumed the character of spasmodic croup, for which the medical attendant had applied leeches to the throat, and administered an emetic followed by an active purgative, and one grain of calomel every four hours. On awaking this morning, the alarming symptoms of croup had subsided, but the right foot had become contracted. It presented a perfect resemblance to that form of club-foot denominated Talipes varus; for the heel was not only elevated to the fullest extent, but the front part of the foot was twisted inwardly, and the great toe elevated and apparently shortened, as in fig. 11. The four smaller toes were in a state of semi-extension; the superior

trochlea and round head of the astragalus were prominent on the instep. The bellies of the gastrocnemii muscles were visible in bold relief, indicating their active contraction—a circumstance of peculiar importance in illustrating the spasmodic nature of the distortion. He was unable to move the foot in any direction, the influence of volition in the anterior tibial muscle being completely overpowered by the spasm of the surales: he was also unable to exert the peronei, and direct the point of the foot outwardly, in consequence of the contraction of the tibialis posticus; but he could act on the flexors and extensors of the toes, though not to their fullest extent, as the state of mechanical tension in which the extensor tendons of the toes were retained by the distorted position of the foot prevented the complete exercise of the functions of the flexors.

It was evident that the distortion was not the result of paralysis of the tibialis anticus and peronei tendons, as the steady application of considerable force with the hands was necessary to overcome the contraction of the gastrocnemii and posterior tibial muscles, and restore the foot to its natural form; from which it immediately relapsed on removal of the pressure. On directing my attention to the hands, I found them affected in a similar manner; the pronator muscles held them prone; the opponens and flexor brevis pollicis muscles drew the metacarpal bone of the thumb towards the hypothenar, or fifth metacarpal bone; and the flexors of the wrist and fingers maintained the articulations of these parts in a state of partial flexion. The influence of volition over the supinators and extensors did not suffice to counteract the contraction of the spasmodically affected muscles: separation of the fingers was the only motion of which the hands were susceptible. The left hand was more severely affected than the right. The contraction of the gastrocnemii and of the other muscles did not occasion any sensation of pain; which is remarkable, when compared with the severity of the pain of cramp in the calf of the leg in diarrhœa and other affections. Having on former occasions attended this child in consultation, I am

able to state that he had never previously experienced any similar attack, or had any complaint distinctly recognised as proceeding from disorder in the nervous system. He stated having latterly felt, when in the act of walking, pricking sensations in the calf of the right leg; but as he had not mentioned this to his parents, it is inferred that they were of little moment.

Habeat balneum calidum instanter; applicentur hirudines vj. spinæ dorsi inter scapulas, et postea vesicatorium eodem loco. Perstet in usu Hydrargyri Chloridi.

2 P.M. When removed from the warm bath, the spasmodic contractions were considerably diminished, the patient being enabled partially to move the wrists and ankle; the leeches were notwithstanding applied, after which recovery of the limbs speedily ensued. He is at present in a profuse perspiration, and, beyond a slight cough, does not appear to labour under any particular symptom. The remaining portion of the prescription was consequently dispensed with.

March 2d. He is quite well, and anxious to be permitted to take animal food. Not the slightest trace of spasm of any of the muscles remains.

Jan. 2d, 1839. The patient, whom I have since occasionally visited, has not experienced any return of the spasmodic affection of the larynx or of the extremities; he possesses full power of volition in the muscles previously affected, and is in excellent health.

Remarks.—This case greatly contributes towards completing the history of the occurrence of non-congenital Talipes; illustrating the mode of seizure, the analogy between this affection of the lower extremity and spasmodic affections of other parts of the body, and their dependence on the same causes. It also serves to indicate the treatment requisite in similar cases, and to assist in comprehending the condition of the affected parts of the nervous system. The croup, with which the patient had been attacked on the evening previous to the occurrence of the distortion, was supposed to have

been attributable to inflammation of the larynx and trachea: hence the application of leeches, and the administration of the emetic purgative and calomel. But the appearance of spasmodic affection of the limbs on the following morning, in conjunction with the total cessation of the laryngeal symptoms, proved the spasmodic nature of the laryngeal affection, and directed attention to the viscera of the abdomen, more particularly to the mucous membrane of the alimentary canal and medulla spinalis. I considered that the spasmodic contraction arose from visceral disturbance, not distinguished by local symptoms, but affecting peripheral extremities of nerves, which, by propagation of disturbance to the spinal cord, induced the reflex phenomenon of abnormal muscular contraction in distant parts of the system. The co-existence of spasm in both hands and arms with the distortion of the foot, proved that the affection of the medulla spinalis was not of very limited extent. I was of opinion that the latter important organ and the alimentary canal demanded, in the first instance, therapeutic attention, and that relief could be afterwards administered to any other abdominal or pulmonary organ that might be found disordered. The warm bath, leeches and counter-irritation applied to the spinal column, were prescribed, as the means most likely to remove the congestion of the affected portion of the nervous centre; and the continuance of the evacuation of the bowels, and the peculiar influence exercised by calomel on the chylopoietic organs, offered the best prospect of removal of the exciting cause of the reflex phenomena. The result justified the most sanguine expectations; the warm bath having produced the beneficial influence frequently witnessed in affections of the nervous centres unconnected with active inflammation—a marked diminution of the spasm. The subsequent copious perspiration, and the leeches to the spine, completed its removal.

I have, in the Remarks on Case XXV., alluded to the occasionally transitory nature of spasmodic contraction; it is possible that in this case it might have spontaneously subsided, although probable that, but for the treatment adopted,

the morbid condition of the spinal marrow (its congestion, if the knowledge of the pathology of the medulla spinalis justify the assumption of this term) would have been more lasting, perhaps permanent; and the cure of the distortion would then have required division of the tendons of the contracted muscles.

CASE XXVII.

TALIPES EQUINUS CONGENITUS.

Congenital spasmodic elevation of the heels, combined with some rigidity of the knee and hip joints, arising from abnormal contraction of the muscles of the lower extremities. Similar contraction in other parts of the body. Cured without operation.

March 20th, 1838. ** **, a boy aged three years and a half, although his appearance did not indicate more than two years. The mother states that he was born at the period of seven months of gestation, and that, shortly after birth, she observed a stiffness in all the articulations of the lower extremities: he has always been a healthy child, having suffered no indisposition but that attendant on measles. When an infant, he did not notice objects like other children, and did not commence speaking until the third year; he has since rapidly improved in these respects, but has never walked. He had an inguinal hernia during the first two years. The head is drawn backwards with some degree of stiffness, the eyes seem almost immovable in their sockets, and the pupils are unusually dilated, which present the appearance as if he were constantly looking towards the ceiling. When placed to the ground and desired to walk, the knees are firmly crossed; and in the attempt he moves the legs alternately forwards without bending any of the joints, the toes only touching the ground. The contraction of the gastrocnemii can be overcome by pressure with the hands; but elevation of the heels returns on removal of the

extending power; the knee and hip-joints are more freely movable in every natural direction, although, from the absence of efficient control over their muscles, he is unable fully to bend them.

℞ Hydrargyri Chloridi gr. j.
Pulv. rad. Rhei, gr. vij.
M. ft. pulvis, tertiâ quâque nocte sumendus.
℞ Tinct. Cantharidis,
Linim. Camphoræ,
Olei Terebinthinæ partes æquales.
M. ft. embrocatio, columnæ spinalis totæ longitudini nocte maneque infricanda.

April 17th. He somewhat improved during the first fortnight, but much more within the last ten days. The rigidity of the articulations of the lower extremities is diminished; he makes better attempts to walk, and the gastrocnemii do not retain the feet in such a complete state of extension, as he is enabled slightly to bend the ankles. The head is less drawn backwards. As the embrocation speedily produces vesication, its alternate application on either side of the spinous processes is directed, and the powders to be continued.

May 15th. Is commencing to stand by supporting himself against a chair or table. When assisted in walking, he places the entire sole of each foot flat on the ground, although the knees are occasionally crossed (the left being foremost); and the adductor muscles of the thighs and flexors of the knees still appear more tense than natural, particularly those of the left extremity: the head is no longer held backwards. Ordered the continuance of the embrocation, and one powder to be taken every fifth night.

June 5th. Continues to improve, and apparently possesses so much power over the muscles of the extremities, that he may be expected, after sufficient practice, to have the complete use of his limbs. Recommended the discontinuance of the embrocation, and the occasional administration of a powder when requisite from confinement of the bowels.

July 17th. The rigidity of the adductors of the thighs

and flexors of the knees has partially returned, and he again crosses the limbs in attempting to walk; for which a renewal of the treatment is prescribed.

October 3d. The mother of this patient has unavoidably absented herself until this day. She states that a short period after the date of the last report, under the operation of the medicines, he again improved. The progress has been constant; and he now walks without support, treading quite evenly on the soles, although the knees occasionally strike against each other, and cause him to fall: he can also freely bend the articulations, the motion of which was formerly limited. The appearance of staring and prominence of the eyes, from involuntary contraction of the orbital and ocular muscles, continues, although the mother states that he has acquired greater power of directing them towards objects. His general health is good; the powders, which he has continued twice in the week since last report, act freely on the bowels, and do not appear to occasion any weakness. The counter-irritation to the spine has been continued in a moderate degree. Ordered the diminution of the powder to half the dose.

January 1839. Patient has been brought to me since last report; his gait was equal and steady, although less firm than usual in a child four years and a half old. The adductor muscles of the thigh did not appear to be entirely relaxed at will, as they still felt somewhat tense, although the degree of contraction remaining had but little influence on his gait. The contraction of the muscles of the eye also continued.

Remarks.—The complete recovery of this patient may be anticipated from the gradual and uninterrupted amendment which, with a temporary exception, has taken place. The nature and cause of the abnormal muscular contraction, and the influence exercised by the treatment may with propriety be considered.

This case is analogous to Case IX., with reference to the birth of the individual at an early period of gestation, and

the various parts affected. The *remarks*, page 118, on the cause of the affection, are applicable to both cases. An important difference, however, existed between them: the extensor muscles, as well as the flexors, were in the present case affected; although where the disproportion in their relative power is naturally great, one class of muscles preponderated: thus, in the trunk of the body, those of the back had the advantage, and in the leg, the gastrocnemii; in the hip and thigh the flexors and extensors counteracted each other, although the adductors of the thigh constituted an exception. It would therefore appear that the power of volition was not diminished through partial paralysis of the voluntary motor nerves of one set of muscles, but from inordinate activity of the involuntary contractility of both sets, induced by derangement in the medulla spinalis affecting the origins of the involuntary motor nerves of a large portion of the muscles of the body.

CASE XXVIII.

TALIPES VALGUS CONGENITUS.

Congenital distortion of the right foot from contraction of the peronei, anterior tibial, and gastrocnemii muscles. Cured by division of the tendons of the peronei and gastrocnemii muscles.

August 23d, 1838. ** **, a boy four years of age, was born with the distortion represented figs. 4 and 37, consisting of a threefold alteration of the natural position of the foot, but precisely opposite to the deformity of Talipes varus; the ankle being bent, the toes and sole directed outwardly, and the external margin raised from the ground. In walking he does not touch the earth with any portion of the sole, but treads entirely on the inner surface of the instep and the internal malleolus, in consequence of the extent of the rotation of the foot on its antero-posterior axis. The tendons of the peronei muscles and the tendo Achillis are tense, and oppose the attempt to reduce the foot to a proper position by means of the hands. From the imperfect development

of the external malleolus, and the contraction of the peronei muscles, the tendons of the latter are situated more anteriorly

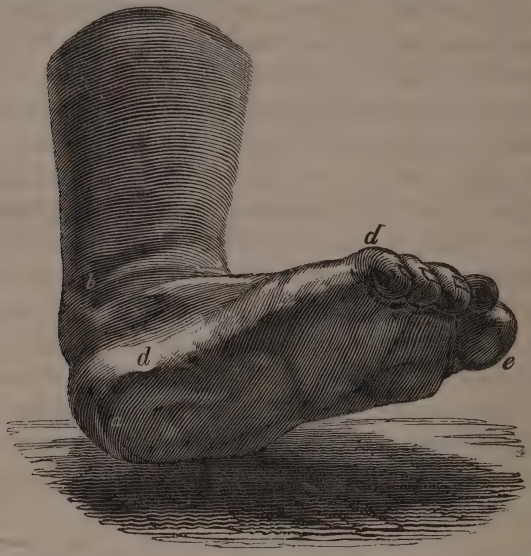


FIG. 37.—*Posterior and external view of congenital Talipes valgus of the right foot.* *a*, the inferior surface of the heel, presenting backwards and outwards; *b*, the external malleolus; *d*, *d*, the external margin of the foot, greatly elevated from the ground. In consequence of flexion of the ankle, the great toe, *e*, is raised from the ground, although the internal edge of the foot is directed towards it.

and externally than in the natural relation of the parts; and owing to the alteration in the position of the bones of the ankle-joint and tarsus, the tendo Achillis deviates outwardly. The affected leg is a quarter of an inch shorter than the other, and somewhat thinner; the difference in the length of the foot is half an inch. He can freely move the toes, but possesses little voluntary power in any of the muscles of the ankle-joint, the posterior tibial muscle (and the flexors of the toes, with reference to their action on the ankle-joint) being overpowered by the contracted peronei and anterior tibial muscles. He is unable to produce any additional bending of the ankle, in consequence of these muscles being already shortened to their fullest extent; and the attempt to raise the heel is merely followed by an increased elevation of

its outer side. The inner surface of the ankle and instep, corresponding to the internal malleolus and the internal extremity of the navicular bone, is covered with thickened cuticle from attrition against the earth; whereas it is evident, from the delicacy of the skin of the sole, that no portion of it has at any period touched the ground. The parents state that no alteration of the foot has occurred since birth.

In addition to the deformity, the patient labours under a considerable difficulty in articulating even the more simple sounds.

Divided the tendons of the peronei and the Achilles tendon, with only a single puncture in the integuments; the resistance instantaneously ceased, and the foot could be restored to its proper form; but, for the purpose of preventing too great separation of the divided tendons, and of ensuring their perfect reunion, the edges of the puncture were brought into apposition with adhesive plaster, and the foot secured to a pasteboard splint moulded to the deformed limb. On the third day, the puncture having united, an instrument (the "retentive apparatus," described page 68) was applied, and the coagulable lymph connecting the severed tendons gradually elongated.

On the seventh day, the foot was entirely restored to its natural position, without any sensation of pain having been experienced; and he was allowed to take exercise. The imperfect development of the external malleolus, the laxity of the internal ligaments of the ankle-joint, and the weakness of the muscles on both sides of the leg, which favoured a return of the deformity when the weight of the body was sustained by the affected limb, required the application of the apparatus for a considerable length of time.

At the expiration of three months the relaxed muscles and ligaments had acquired sufficient tone to enable him partially to rest on the limb without the assistance of the apparatus. He had for some time walked without the appearance of any lameness. A more simple contrivance, attached to a common boot, was now substituted during the day, the former one being still worn at night. No defor-

mity remained (see fig. 38); the ankle-joint could be flexed, and the foot moved both inwards and outwards with the

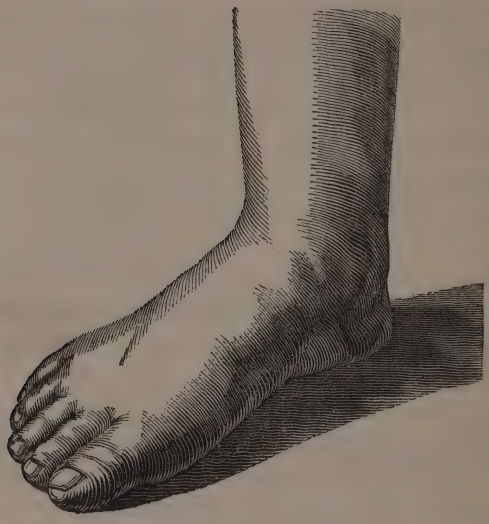


FIG. 38.—*The foot of Case XXVIII., (figs. 4 and 37,) as it appeared after the cure.*

hands, although the contraction of the tibialis anticus prevented complete extension, and caused him to tread more firmly on the heel than on the front part of the sole. He could voluntarily execute the greater part of the natural movements of the joint. He subsequently returned to his home in the country, the parents being recommended to postpone his wearing a common boot until the weakness of the inner ankle had entirely subsided.

March 1st, 1839. I have the satisfaction of knowing that not the slightest tendency to relapse has taken place; and a considerable improvement, both in the strength and bulk of the limb, has resulted.

Remarks.—This case demonstrates the practicability of immediate removal of Talipes valgus by division of the contracted tendons, even when pressure with the hand is insufficient to effect more than a trifling improvement in form. It moreover illustrates the degree of care requisite after the operation, to prevent relapse, as the act of walking

before the muscles and ligaments on the inner side of the ankle-joint have acquired strength, tends to reproduce displacement, and thus encourage a recurrence of contraction in the muscles divided on the outer side of the articulation. The injury which, after the operation in T. valgus, may possibly result from too early exercise, without proper mechanical support, may be contrasted with the advantage of exercise soon after the operation in all cases of T. equinus, and in many of those of T. varus; as, the weight of the body in these distortions being thrown on the tarsal arch, maintains depression of the heel and the elongated state of the gastrocnemii, enabling flexion to at least a right angle to be performed; although, if flexion to a more acute angle have been accomplished by mechanical extension after the operation, it is necessary in order to retain it, that the limb should at certain periods be flexed to the fullest extent.

Division of the tendon of the anterior tibial muscle was unnecessary from its contraction having been slight, and the circumstance that after the superior trochlea of the astragalus was replaced horizontally beneath the axis of the limb, by removal of the unnatural abduction of the foot, the weight of the body, acting on the summit of the tarsal arch, tended to keep the anterior tibial muscle extended, and prevent elevation of the toes from the ground.*

CASE XXIX.

Paralysis of the lower extremities during dentition, unaccompanied with distortion.

March 6th, 1838. ** **, a boy æt. twenty months, brother to the subject of Case XXVII. His mother states that until the age of fourteen months he had good health, and at that period could run alone. Whilst cutting the upper

* The co-existence of contraction of the gastrocnemii and anterior tibial muscles appears anomalous; but, from the elevation of the front of the foot, I am of opinion that the primary cause of the distortion was contraction of the

canine teeth, he one day suddenly fell, apparently from total loss of power in the lower extremities. She had not previously noticed any weakness or other cause by which the fall might have been produced. He lost the power of speech for a fortnight, remaining restless in bed, his eyes fixed, and without taking notice of surrounding objects. On recovering his senses and speech, he was found to have entirely lost the use of the left arm and leg. The paralysis of the arm quickly subsided, but it continued in the leg. About a fortnight since, after having attempted to exert the left leg in crawling, the mother noticed that the right leg "was dragged after him on the ground." At the present time there exists incomplete paralysis of motion in both the lower extremities, but more severely in the left, the muscles of which, from the nates downwards, are thinner, and the temperature lower, than those of the other. He is unable to stand; and when assisted in the attempt to walk, he evinces but little inclination to move his limbs. The appetite and condition of the bowels have throughout been good, even during the period that he remained insensible. Ordered the following prescription, and the continuance of his ordinary diet of meat, bread, and milk:

℞ Hydrargyri c. Cretâ gr. iij.
Pulv. Rhei gr. vj.
M. ft. pulvis, alternâ quâque nocte sumendus.
℞ Tinct. Cantharidis,
Olei Terebinthinæ,
Linim. Camphoræ partes æquales.
M. ft. linimentum, nocte maneque unocuique lateri spinæ infricandum.

March 20th. He appears stronger and more lively, and steps better. His bowels are freely acted on by the powders. The liniment has produced considerable irritation and partial

anterior tibial and peronei muscles only; and that the necessity for division of the tendo Achillis arises from its outward deviation from its course, in consequence of the abnormal position of the foot, induced by contraction of the peronei. In a similar non-congenital case I distinctly ascertained the absence of shortening of the gastrocnemii; and, after the resistance of the peronei was overcome, succeeded in restoring the foot to its proper form.

vesication along the spine, conjointly with which the mother noticed the improvement in the limbs.

Perstet.

April 17th. Patient can stand alone, and when supported, can walk both freely and firmly. As the embrocation continues to produce considerable irritation and excoriation, the mother is desired to rub it alternately on either side of the spine, in order, after each application, to allow time for partial recovery of the skin.

May 14th. The child gains strength, stands, and occasionally steps, alone, and can walk with very slight assistance. The temperature of the left extremity is still below the natural standard.

Capiat pulvis bis in hebdomade.
Cont. linimentum.

July 17th. He now runs alone; the muscles are increasing in firmness, and no trace of paralysis remains.

Remarks.—The history of this case is here introduced, notwithstanding the absence of deformity, for the purpose of shewing the resemblance in the plan of treatment necessary for the cure of paralysis of infants, whether attended with contraction or not. The paralysis was incomplete in degree, although it equally affected the whole of the muscles: and appeared, from the absence of any contraction, to have involved the involuntary motor contractility as well as the voluntary motor power.

The uncertainty in the prognosis of paralysis of children is a subject worthy of attention. It frequently subsides spontaneously after the lapse of a variable period—from one or two months to two or three years; and in some instances defies the most judicious therapeutic efforts, the sufferer remaining paralytic through life. But great benefit unquestionably results from medical treatment, modified according to the condition of the constitutional powers of the patient. In some instances I have succeeded by active purging, diminution of diet, and extensive counter-irritation; whereas in others the latter, combined with ferri sesquicarbonas, ferri iodidum, and augmentation of diet, have been requisite.

CASE XXX.

TALIPES EQUINUS ACQUISITUS.

Non-congenital contraction of the gastrocnemii from partial paralysis of their antagonists; consequent deformity of the foot, resembling the simplest form of congenital Club-foot. Cured without operation.

Nov. 19th, 1837. ****, a fine stout child, aged twenty-one months, with dark blue eyes and light brown hair, is stated by his mother to have been born with perfectly sound limbs, and to have walked without assistance at the age of sixteen months. He has never had any serious indisposition, but has been subject to prolapsus ani, slight diarrhœa, and the occasional expulsion of thread-worms. Within the last four months he has become affected with a considerable lameness in the right foot, evinced by an inability to place the heel on the ground; but on careful inquiry, the fact is elicited that the mother had some time previously noticed a "dragging" or "weakness from the hip downwards," at which period the child placed the foot perfectly flat on the ground. She also remembers having observed, prior to the commencement of the lameness, that the right foot was somewhat smaller than the other, and that its temperature was diminished.

At present he walks on the anterior part of the sole corresponding with the articulations of the metatarsal bones with the toes (as in fig. 2), and is unable to bend the foot: in making the attempt, neither the tendon of the anterior tibial nor that of the extensor longus digitorum muscles are rendered tense; but the great toe, at all times partially raised, is then perfectly extended. The contraction of the gastrocnemii is rigid, yet the foot may be completely bent by pressure with the hand; on removal of which, the deformity immediately returns. The tibia is more slender than that of the sound limb, and the muscles of the nates, thigh, and leg, are less firm: the extremities are of equal length. The wasting of the muscles from the hip downwards, the elevation of the heel, and the mode of progres-

sion, have hitherto caused the affection to be mistaken for disease of the hip-joint. The child appears in good health; the bowels are regular, and the appetite *voracious*.

Capiat æger Hydrargyri submur. gr. j. cum pulv. Rhei gr. viij. tertio quoque die.
℞ Ol. Terebinth.
Tinct. Cantharidis,
Linim. Camphoræ singulorum ʒj.
M. ft. linimentum, spinæ dorsi bis quotidie infricandum.

The mother is directed to permit the child freely to exercise the limb, and is also recommended, two or three times during the day, alternately to flex and extend the ankle to its fullest extent, to prevent the occurrence of structural shortening of the muscles on the back of the leg.

Dec. 20th. Patient is already enabled to tread more flatly on the foot, and his mother is of opinion that he possesses greater power over the limb. The powders caused the discharge of a considerable number of worms, and have improved the character of the alvine evacuations. The spinal column is very sore, from the effect of the liniment. The affected joint has become more flexible.

Feb. 1st, 1838. The amendment continues, and the child takes exercise freely; his gait is more steady, and the heel is placed much nearer the ground, touching it when the entire weight of the body is borne by the limb.

March 3d. He has taken the powders less frequently since last report, and the application of the liniment has been partially discontinued. He now possesses sufficient power over the muscles of the leg voluntarily to bend the ankle: it is nevertheless evident that the action of the muscles on the posterior aspect preponderates. A trifling limp, caused by the inequality of the power of the muscles of the affected limb when compared with those of the other, is the only remaining indication of the former lameness. This will probably subside when the limb has been exposed to increased exercise. Ordered the discontinuance of the

powders and liniment, but desired the mother to persevere with frictions and manipulations.

I have since occasionally seen the patient; he is perfectly free from paralysis, and walks without any lameness.

Remarks.—The disturbance in the nervous system, on which the paralysis and contraction depended, was apparently the result of the irritation of intestinal worms, and the morbid sensibility of the mucous membrane of the alimentary canal; the remote cause of the whole probably being the improper quantity and quality of the food in which this patient had been permitted to indulge. Cessation of both the paralysis and contraction was the speedy result of a restoration of the alimentary canal to a more healthy condition, and the diminution of the plethoric state of the constitution by the frequent and regular administration of purgatives. The extensive counter-irritation to the spine acted in its peculiar but indescribable manner, by assisting to diminish the congestion of the spinal cord.

CASE XXXI.

TALIPES EQUINUS ACQUISITUS?

Non-congenital distortion of both feet, from spasmodic contraction of the gastrocnemii muscles. Similar affection of the muscles concerned in the articulation of sounds.

Nov. 2, 1838. ****, a boy aged three years and a half, is stated by his mother never to have walked properly, being affected with lameness in both feet, but more particularly the right. It was first observed about eighteen months since, when he began to walk—the late period of commencing progression having been attributed to weakness. He had never experienced any of the ordinary infantile diseases, nor been affected with any particular illness; but the process of dentition was difficult and painful, attended with emaciation and disturbance of rest. He was brought up by hand,

and every description of food continually disagreed with him, producing sickness and relaxation of the bowels.

He can with difficulty support himself alone, and is constantly in dread of falling, which often occurs, as only the front part of the feet touches the ground; in standing or walking the whole frame totters, and he appears in danger of losing his balance. The *right* heel is elevated to its fullest extent by contraction of the gastrocnemii, the belly of which is visible in bold outline firmly contracted; but it occasionally relaxes, so as to permit of his treading on a larger portion of the sole. The attempt to bend the ankle by the action of its muscles is futile, the sole result consisting in an elevation of the great toe. The *left* heel is also raised in the act of walking; but when seated he can exert the anterior tibial and extensors of the toes sufficiently to bend this foot, although when volition is not exercised, the ankle is completely extended. The active contraction of the gastrocnemii of the left leg is evident from the great prominence of the belly of these muscles. The heels are easily forced to the ground by pressure upon his knees, but they are immediately raised on its removal. The circumference of the right leg is somewhat less than that of the left. The thighs are well developed, and no contraction of the knee exists. The mother has always observed that he was particularly liable to be startled, and occasionally almost convulsed, by trifling exciting causes, such as the noise of shutting a door. There is a slight impediment in his speech; he appears sometimes to labour in his utterance, and after ineffectual attempts at pronunciation, the words are suddenly ejected. His mother mentions, as another symptom of the excitability of his system, that during infancy his head was jerked backwards, and his shoulders drawn towards the lumbar region, in a peculiar manner, which she had never noticed in other children. A careful inquiry respecting the precise period when these symptoms and the contraction in the feet were first perceived, raises a doubt of the non-congenital nature of the affection. The mother attaches considerable importance to the circumstance of a severe fright

experienced at the commencement of the seventh month of pregnancy, and to having been six days in labour.

Feb. 1839. The treatment pursued has consisted in the exhibition of the sesquicarbonate of iron, the application of a rubefacient liniment to the entire spinal column, frictions and manipulations of the limbs, and the adaptation of mechanical apparatus, to endeavour to retain the feet in the bent position, and thus facilitate his taking exercise; under which the case is progressing favourably.

Remarks.—This case is inserted to illustrate the pathology of Talipes; but being still under my care, I have omitted the detailed report of the treatment, as no therapeutic conclusions could with propriety be deduced. A note of interrogation is inserted at the heading of the case, to indicate that it cannot be satisfactorily determined, either from the statement of the parent or from the symptoms, whether or no its origin was congenital. From the development of the limbs being perfect—from the derangement in the functions of the alimentary canal which attended the process of dentition, calculated by its effects on the nervous system to have produced the distortion—and from the doubt existing in the mind of the parent,—I am inclined to the opinion, that the spasm of the muscles occurred subsequently to birth; but if congenital, it must have taken place at a late period of utero-gestation, perhaps even after commencement of the process of parturition.

CASE XXXII.

TALIPES EQUINUS CONGENITUS.

Congenital distortions of the right foot, from contraction of the gastrocnemii muscles. Cured by the application of mechanical instruments.

June 15th, 1837. ****, a fine boy aged nine months, born with a distortion of the right foot, consisting of an elevation of the heel, with very slight twisting inwards of the toes.

The gastrocnemii muscles are contracted; but the foot, by means of gentle pressure, can be bent to a right angle with the leg. When at rest, the elevation of the heel is constant, and the great toe extended in the manner characteristic of Talipes. The point of the foot is frequently drawn inwardly, but the foot is never observed to become flexed; consequently no relaxation of the gastrocnemii takes place.

The father, a member of the medical profession, has attempted the reduction by securing the foot with adhesive plaster and a bandage to a wooden splint, which he believes to have been attended with some benefit; but the slow progress of the case, and the circumstance of my having successfully divided the tendo Achillis for the cure of a similar distortion in another member of the family, induced him to consult me as to the propriety of an operation in this case. From the yielding nature of the contraction of the gastrocnemii, the absence of actual deformity, and the comparative mildness of the form of the disease, I determined to rely on mechanical treatment, and recommended the application of the instrument figs. 14 and 25; by which means, assisted by the assiduous attention of the parent, and the beneficial effects of his attempt to walk, the distortion within eight months was entirely removed; and no relapse has since taken place.

Remarks.—This cure by the application of mechanical instruments is related simply for the completion of the series of illustrations of the various methods which may occasionally be resorted to in the treatment of distortions. The detail of the progress of many other cases cured by mechanical means would be totally void of interest or instruction, as the daily removal of the apparatus that may be employed to effect the extension of the contracted muscles, and the careful and gradual augmentation of the power employed for the purpose, in proportion as the patient advances in age and strength, are the points principally requiring attention. The minutiæ of the treatment of infantile cases in general have been already described (pp. 26 and 171 et seq.).

CASE XXXIII.*

TALIPES EQUINUS *INTERMITTENS* ACQUISITUS.

Spasmodic contraction of the gastrocnemii of the left leg, occurring on contact of the sole with the ground, supposed to have been produced by an injury to the limb from accident. Cured by division of the tendo Achillis.

****, a youth aged sixteen years, in robust health, states that about eight months since, on jumping violently from a table, he experienced pain in the situation of the internal malleolus, and was unable to place the heel to the ground. The medical attendant, who was not consulted until eight weeks after the accident, was of opinion that displacement of some tendon had been effected. The pain subsided after local applications, but the lameness has continued, the heel being still raised from the ground, when in the erect position, to the extent of two inches. He is unable to depress the heel, either by resting the entire weight of the body on the limb, or by exertion of the anterior muscles of the leg. The muscles of the calf are well developed, but contracted; and the tendo Achillis is tense. There is no inclination of the tarsus either inwards or outwards, the form of the foot being perfect.

These symptoms at first suggested the existence of a considerable *permanent* contraction of the calf; but this idea was abandoned, on discovering that he could, in the sitting posture, move the ankle in every proper direction. The anomaly was then attempted to be explained by the supposition that in this position, the knee being flexed, sufficient relaxation of the gastrocnemii muscles occurred to admit the bending of the foot. The inaccuracy of this opinion was, however, demonstrated by the fact, that the patient, lying on his back, with the knee-joint and muscles of the calf extended, was enabled to effect every natural motion of the

* This case was treated by Professor Dieffenbach and myself during my residence in Berlin, and was published in my Dissertation previously quoted. From its physiological and pathological interest, it has been transferred by Dr. Stromeyer to his "Beiträge zur operativen Orthopädik, Hannover, 1838," p. 94.

ankle—flexion and extension, adduction and abduction. It was therefore evident that when the gastrocnemii muscles were perfectly quiescent, not being called into activity by locomotion, they could be voluntarily elongated by the action of their antagonists—the muscles of the front of the leg; but that in the erect position, with the toes touching the ground, the gastrocnemii became so powerfully affected with spasm, that the heel, notwithstanding the weight of the body, was elevated to the extent of two inches.

The tendo Achillis was divided Nov. 1st, 1836. On the fourth day, the puncture having united, the foot-board of Stromeyer was applied, with a view to effect the bending of the foot to its fullest extent, which was accomplished in a few days without the occurrence of pain; no resistance having been offered either by the remaining muscles of the limb, or the ligaments of the joint. The patient was then desirous of taking exercise; but the necessity of retaining the full extent of flexion of the joint, and thus ensuring a sufficient length of the medium uniting the extremities of the tendon, required the continued application of the apparatus. At the expiration of a fortnight, he could move the foot in every direction without inconvenience, and took exercise in the apartment; wearing the apparatus during the night, to prevent any contraction of the lymph whilst undergoing the process of consolidation.

Nov. 20th. He has already walked the distance of a mile, wearing a common boot; and shews no appearance of lameness, except a slight limp in walking quickly, when he experiences some tenderness in the tendon, and also on bending the ankle to its fullest extent.

Nov. 25th. He complains of some degree of weakness in the foot, and an inability to bend the knee with his original power. This demonstrates the influence exercised by the gastrocnemii in bending the knee in the normal state.

Dec. 2d. All tenderness has subsided, and he only feels a trifling stiffness in the tendon on first arising in the morning.

Dec. 26th. He has taken much exercise, has not the

slightest appearance of lameness, and feels neither pain nor inconvenience.

Remarks.—I have republished this case on account of its great physiological and pathological interest; the spasmodic nature of the affection, evinced in many contractions in the feet, having in this instance been particularly striking (see pages 104, 5). It eminently illustrates the abnormal condition of the reflex functions of the nervous system, and differs from most spasmodic affections in the exciting cause of the spasm being so completely within observation. In similar affections of other muscles,—the sterno-cleido-mastoideus, the trapezius; those muscles of the face from spasm of which risus sardonicus and blepharo-spasmus result; those of the œsophagus producing spasmodic dysphagia; those of the urethra; those of the sphincter ani; and also in trismus and tetanus, —we are frequently ignorant of the precise spot whence the morbid phenomena emanate. But in this case the links in the *reflex* chain are evident; viz., the cutaneous nervous filaments of the sole—the medulla spinalis—the motor nerves of the gastrocnemii muscles. The non-sentient cutaneous filaments (*incident* of Dr. Hall) being excited or irritated by contact of the sole with the earth, propagate the impression to the spinal cord, whence it is reflected by the involuntary motor filaments to the gastrocnemii muscles, and spasmodic contraction ensues.*

In the majority of spasmodic affections of single muscles, or of a class of associated muscles, we observe that the part from which the reflex (*excito-motory*) phenomena emanate, stands in intimate physiological relation with that in which the spasmodic contraction takes place. As in the act of deglutition, the mucous membrane and muscular fibres of the œsophagus are connected as excitor and excited, the medulla spinalis being the intermedium; so in spasmodic dysphagia the same chain of organs is implicated, the pathological phenomena apparently consisting only of an excessively increased energy of the physiological actions. From

* This explanation was likewise published in my former Dissertation.

this analysis of spasmodic dysphagia, may we not, considering the pathological connexion of the gastrocnemii muscles with the cutis of the sole, synthetically determine their physiological connexion? Is it not probable that these muscles, so highly important in maintaining the erect position of the human frame, are so connected with the skin of the sole as to constitute the first and last links of a physiological chain, through which, subject to the control of the will, the power of contraction of the muscular fibres is augmented?

But although we may point out the chain by means of which the reflex phenomena in this and similar cases may have taken place, the exact nature of the change in the central organ of the nervous system, or in the incident and reflex nerves through which the latter may have become capable of producing the morbid phenomena, is, in our present knowledge of the pathology of the nervous system, only a matter of speculation. I have already alluded to this subject in the remarks appended to Case XXIV.

A clear understanding of the pathology of this case is involved in considerable difficulty, from the circumstance of the patient's history of the commencement of the affection militating against the opinion I have expressed of the usual origin of spasmodic affection of the gastrocnemii. The statement of the occurrence of the contraction immediately after the act of suddenly jumping from a table, would, if considered the real cause of the affection, irresistibly lead to the conclusion, that an injury had been inflicted either on the motor nerves distributed to the gastrocnemii, or on the muscular fibrillæ. Were the former, at the moment of the patient's alighting on the ground, subjected to mechanical injury by the vehement motion of the limb? or were the latter injured by the suddenness and violence of their contraction, by which the excitability of the incident and irritability of the reflex motor nerves were increased to such an extent that the physiological (reflex) action of the sole on the gastrocnemii became so excessively augmented as to induce the pathological phenomena? Did the medulla spinalis experience a commotion at the period of the acci-

dent, by which the roots of the particular nerves interested may have been affected?

It is doubtful whether much confidence can be placed in these mechanical explanations; and although I am willing to extend the utmost consideration to the patient's statement, having carefully interrogated both himself and his parents, I am inclined to believe that the spasmodic contraction depended on some chronic derangement of an organ involving a peripheral part of the nervous system, or on disease of the central organs of the latter (see pages 104, 5), and that the local injury of the limb was an accidental complication.

Dr. Stromeyer, in a note to this case, relates a similar and equally instructive contribution to the pathology of distortions.* Cases XXVII., XXXI. also illustrate the distinctly intermittent spasmodic contraction of the gastrocnemii.

CASE XXXIV.

TALIPES EQUINUS ACQUISITUS.

Non-congenital distortion from contraction of the gastrocnemii and other muscles on the posterior aspect of the right leg, converted by constant exercise into a deformity resembling, in external appearance, T. varus, originating from paralysis. Cured by division of the tendo Achillis, and subsequent mechanical extension, after the distortion had existed forty-eight years.

Nov. 22d, 1838. Mr. **, in his fiftieth year, of a stout, robust habit, states, that at the age of eighteen months, whilst suffering from a trifling indisposition, occasioned by the process of teething, he was affected with a lameness of

* "I have very recently witnessed a perfectly similar case in a girl eighteen months old, whose right foot assumed, in the act of walking, the form of Pes equinus, but which totally disappeared in the sitting and recumbent postures. The only difference consisted in a trifling degree of flattening of the Achillis tendon, from which the inference might be deduced, that the affection of the muscles of the calf was not of recent duration. The treading on the point of the foot was observed on first attempting to walk. The functional (intermittent)

the right leg, succeeded by contraction of the muscles and distortion. Various practitioners were consulted during childhood, and numerous methods of cure resorted to, none of which succeeded in effecting a removal of the distortion, although the condition of the foot has at different periods improved, but never so as to enable the heel to be placed on the ground, or to admit of his walking without considerable lameness and excessive fatigue. During the last thirty years, the deformity and the pain consequent on progression have gradually increased; he is at present unable to walk the distance of a mile without often resting, and even to accomplish this an hour is required. He cannot make a single step without the assistance of a stick in the right hand, on which he supports almost the whole weight of the body: a deformed appearance of the entire frame results, from the elevation of the right shoulder and right side of the pelvis being very considerable; and the body, instead of being equally supported upon both inferior extremities, is alternately jolted from the sound leg to the right arm.

The heel is elevated to the extent of six inches; the tendo Achillis is tense, and adheres firmly to the skin, which is transversely wrinkled. The application of considerable pressure against the front part of the sole does not produce the slightest degree of flexion. When the foot is maintained in the best position of which it is susceptible, it constitutes a case of extreme Talipes equinus; but nevertheless in the act of walking, resembles severe Talipes varus, as in fig. 11. No part of the sole consequently touches the ground, the external and dorsal surface of the inferior extremity of the fifth metatarsal bone being alone exposed to pressure. The skin investing this part is covered with a corn, which, from its extreme sensibility, greatly increases the fatigue of exercise,

Pes equinus, and the spasm of the gastrocnemii producing it, were entirely removed by division of the tendo Achillis, without the application of any mechanical apparatus. Such cases are of the greatest importance with reference to diagnosis, being liable to induce error concerning the real nature of the affection. The lameness in this child had been attributed to hip-joint disease." —"Beiträge zur operativen Orthopädik."

particularly in cold damp weather. The inferior extremity of the metatarsal bone of the great toe, which is entirely removed from the ground, is likewise similarly invested from friction of a cicatrix, the result of a wound produced upwards of twenty years since by the act of walking. The existence of this cicatrix, and the history of its origin, indicate the progressive increase of the distortion, as since its occurrence he has ceased to tread on the part. He is unable to effect a single voluntary movement of the foot; but whether this inability arise from the muscles on the back of the leg being contracted by spasm to the utmost extent, and consequent infliction of injury on the anterior muscles by their having been for so great a number of years forcibly maintained in an elongated state; or whether paralysis of the latter have been the origin of the distortion, and contraction of the muscles on the back of the leg have merely resulted from loss of antagonists,—is a question difficult of solution after so great duration of the affection. But as the knee is somewhat inclined inwardly, and paralysis of its extensor muscles exists, together with considerable weakness of the muscles of the hip of the affected side, and no vibration of the fibres of the anterior muscles of the leg is felt when the patient attempts to bend the foot, it appears more probable that paralysis of the anterior muscles of the leg was the primary cause of the distortion.

Nov. 28th. Divided (with the assistance of Mr. Reeve, of Great Ormond Street) the tendo Achillis by a single puncture, and without the effusion of more than a drop of blood.

On the third day the puncture had united, when extension of the remaining contracted tissues of the ankle was commenced by means of Stromeyer's foot-board. During the first few days little progress in the restoration of the foot was effected; considerable pain, described to be of a rheumatic nature, with some tumefaction, were experienced. The progress soon became more evident; the heel began to descend; the pain caused by the pressure of the foot-board against the ball of the foot was relieved by the introduction of an air-cushion; another apparatus (described p. 94) was

occasionally substituted, in order to vary the points of the foot compressed by the straps and bandages; and sleep was obtained at night through the removal of all extension-apparatus, and the application of tin splints (see fig. 24) accommodated to the angle formed by the foot with the leg. The patient occasionally suffered from indigestion, accompanied with headache, induced by pain and confinement, but, nevertheless, continued to take his ordinary diet, including wine; he assisted the depression of the heel by free exercise in the apartment whilst wearing the apparatus.

At the expiration of six weeks the heel touched the ground, the foot being bent to a right angle and resting on the entire sole. During the ensuing three weeks the bending of the foot was advanced beyond a right angle, by daily wearing the foot-board for a few hours. He was now enabled to commence out-door exercise, wearing a lace-up boot, furnished with an iron on its outer side, extending from the foot to the middle of the thigh, and calculated to support the weak ankle, and remedy the inward inclination of the knee. On commencing more active exertion, considerable pain resulted from tenderness and sensation of great weakness at the inside of the ankle, more particularly from the long-standing cicatrix at the ball of the great toe being again applied to the ground, in consequence of the restoration of the form of the foot. The pain arising from the latter cause, after impeding his progress for two or three weeks, and the failure of several expedients, was effectually removed by the introduction of a cork sole into the boot, perforated opposite to the tender part. The alteration effected in the position of the foot, and consequently in the length of the extremity, (see p. 128,) had so changed the attitude of the frame, and the necessary relations and actions of the different muscles of the hip, loins, and shoulder, that he complained as much of weakness and pain in the trunk, as of stiffness and weakness in the restored limb.

Fourteen weeks after the operation, he could remain in the erect posture the greater part of the day; his improved appearance being matter of astonishment to all his acquaint-

ances; for although his pace was slow, and resembling that of a person recovering from a broken leg, he was perfectly free from deformity. He was at this period recommended daily to increase the extent of his walks, to avail himself of a few weeks' change of air, and to discontinue the iron above the leg.

Remarks.—The cure of a distortion of so severe a nature as that from which this patient suffered, after its existence for a period of forty-eight years, proves that age is no obstacle to the successful performance of the division of the tendo Achillis. The history of this case is almost unparalleled in the annals of surgery, Dr. Stromeyer* only having published one precisely similar. His patient was a lady, aged 50, in the replacement of whose foot he experienced little difficulty, apparently from the nature of her avocations having required comparatively little exercise, and from her having during a number of years resorted to crutches, whereby the injurious effects of improperly walking on the bones of the tarsus had been averted. The subject of the present case, who had simply used a stick, was of a robust, corpulent habit, and of rigid fibre, and had been under the necessity of standing much, by which the displacement of the tarsus had been greatly aggravated; more difficulty had consequently to be surmounted, and a longer treatment was necessary to obtain the entire benefit of the operation than in cases of equal deformity in younger individuals. The degree of success which has attended this case induces me to recommend the performance of the operation at any age, provided the sufferer's general health and pursuits be such as to insure subsequently due appreciation of the benefit in the facility afforded for the enjoyment of out-door exercise.

* "Beiträge zur operativen Orthopädik," p. 82.

CASE XXXV.

TALIPES CALCANEUS.

Distortion of the left foot from contraction of the tibialis anticus and extensores digitorum muscles.

Nov. 1838. Miss * *, aged four and a half years, is stated to have been born with a perfect condition of the feet, but was observed, soon after learning to walk, to have acquired considerable lameness of the left foot, apparently from weakness. The thigh and leg decreased in thickness, the muscles became lax, and the temperature diminished. She gradually discontinued treading on the entire sole, the heel principally receiving the weight of the body, and the front part of the foot becoming elevated. At present, when the patient is seated and the limb is at rest, the foot is distorted in the manner represented fig. 39, its anterior part being

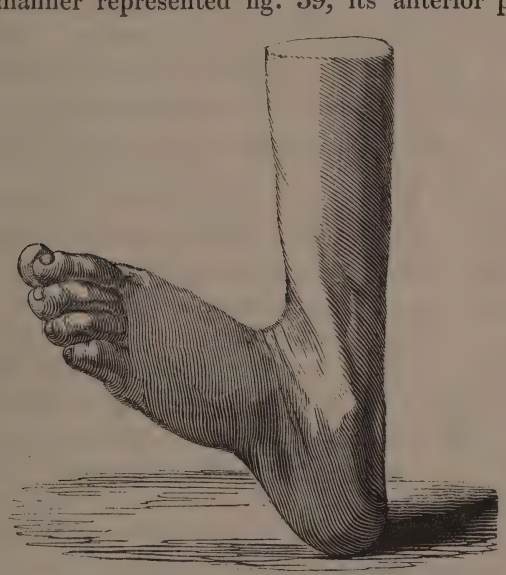


FIG. 39.—*Talipes calcaneus in a child aged four years and a half.*

elevated to the utmost extent, from contraction of the anterior tibial and extensor muscles of the toes, the long axis of the os calcis being situated perpendicularly beneath

the axis of the leg, and the posterior surface of the heel touching the ground instead of its inferior surface: in short, the foot is involuntarily flexed to the fullest extent. No inequality in the elevation of either edge of the foot exists; there is consequently an absence of the abduction of the foot so marked in Case XXVIII., (figs. 4 and 37); although, when the sound limb is carried forward in the act of walking, an outward inclination of the toes, or semicircular movement outwardly of the front part of the affected foot, takes place, the result of the limb resting entirely on the heel as on a pivot. A diminution of the elevation of the toes at the same time ensues, from the weight of the body being thrown on the tarsal arch, which tends to depress both the toes and heels; but as the tension of the muscles on the front of the leg is not counterbalanced by any contraction of the gastrocnemii, the toes continue elevated, although to a less extent. The tendons of the anterior muscles of the leg are felt tense and prominent; the tendo Achillis, on the contrary, can with difficulty be discovered, so flattened and attenuated has it become from the constant elongation to which it has been subjected; its relation to the deeper-seated muscles is also considerably changed. Instead of the existence of a considerable space between these muscles and the tendo Achillis, the latter extends like a thin tape towards its insertion, being closely applied to these muscles and the posterior surface of the ankle-joint—the result of the os calcis being placed almost perpendicularly beneath the tibia, instead of horizontally or obliquely.

As the patient was able to walk without any considerable difficulty, weakness and an occasional tendency to fall being the chief inconvenience of which she complained, and the foot being by pressure easily reducible to the proper form, indicating the absence of structural shortening of the anterior muscles of the leg, I did not consider division of their tendons advisable, but recommended the wearing of a boot furnished with a thin steel support on one side, so constructed as to maintain the foot bent to a right angle only, and cause her to tread equally on the entire sole.

I have since frequently examined this patient. The boot has completely answered the purpose intended, as she treads equally on the entire sole, and walks without the appearance of lameness. The application at bed-time of a tin splint, constructed so as to maintain the foot in the extended position, has been recommended, in order to prevent contraction of the anterior muscles of the leg during the night. It may be anticipated, that as these simple means suffice perfectly to retain the foot in its proper position, the contraction will be ultimately overcome.

Remarks.—This case is added for the further illustration of the nature of Talipes, more particularly on account of its differing greatly from the three ordinary forms of Talipes already described. It constitutes a fourth species of Talipes, bearing the same relation to T. valgus as T. equinus bears to T. varus. It consists simply of abnormal flexion of the foot, T. equinus consisting of abnormal extension, whereas T. valgus consists of flexion with abduction, and T. varus of extension with adduction. In order to distinguish this species, I have ventured to designate it "Talipes calcaneus." It is a form of distortion, of which I have not met with any description. There is an allusion to a deformity, probably of this nature, in a French periodical, under the name of Talus, for the cure of which division of the anterior tibial tendon was successfully performed. This operation was unnecessary in the case I have related; but when any difficulty exists in bending the foot, division of this tendon, followed by wearing for two or three months a boot calculated to prevent a recurrence of contraction, would be the appropriate treatment.

CASE XXXVI.

ANKYLOSIS OF THE KNEE-JOINT.

Contracture or partial ankylosis of the knee-joint from white swelling. Cured by division of the tendons of the ham-string muscles.

The following case, in which I divided the tendons of the biceps femoris and semi-membranosus muscles, for the relief of a partial or so-called ankylosis of the knee-joint, consequent on protracted repose of the muscles in the bent position, during the progress of white swelling of the limb, is added to exemplify the application of the operation of division of tendons in the cure of a distortion analogous to Talipes, although not arising from spasmodic muscular contraction or indirectly from paralysis.

The case was that of a young lady, of the age of eleven years; the disease of the joint had commenced between four and five years previously, and, after suppuration and caries in several situations around the articulation had subsided, two years since, leaving the tibia partially dislocated outwards and backwards, the knee bent to the fullest extent, the patella almost immovably fixed upon the external condyle of the femur, and the toes rotated outwards; the ordinary method of supporting the limb during the progress of the disease having been the placing the outer side of the leg and ankle upon the opposite thigh, close to the inguinal region, where she purposely maintained it, to guard it against any accidental shake or blow. The most appropriate mechanical means, aided by frictions, baths, manipulations, &c., had been resorted to by the surgeons who had attended the case, followed by considerable diminution of the contracted state of the knee-joint. When I first saw this patient the leg could be extended almost to a right angle with the thigh, further extension being arrested by the rigidly contracted flexors of the knee; in which state the limb had obstinately remained for the last twelve months. The ankle-joint was also fixed, the foot being in a straight line with the leg, owing to the more powerful posterior muscles of the leg

having obtained the ascendency over their weaker antagonists during the long inaction of the limb. The muscles of the thigh were smaller than those of the opposite side; but

FIG. 40.—*Partial ankylosis of the knee-joint, removed by division of the tendons of the ham-string muscles.*

a very great disproportion, both of hard and soft parts, had occurred in the leg and foot, the tibia and fibula being between two and three inches shorter than those of the sound side, and the circumference of the leg nearly one half less. Before resorting to other than purely mechanical means for the straightening of the limb, many important considerations were suggested, which are embodied in the following queries.

What is the precise condition of the parts composing the joint?

Is there any alteration in the articular surfaces and ligaments, by which the bending of the joint can be impeded?

What share have the evidently contracted gastrocnemii in maintaining the ankylosis of the knee?

Is there no danger of reproducing the disease of the articulation by performing any operation in its immediate vicinity, and, by a comparatively rapid extension of the limb, disturbing the present quiet state of the ligaments? And should the operation prove successful, and the knee become straightened, will the patient have a limb (the bones and muscles of the leg being shortened and wasted) sufficiently useful to recompense the pain and risk of the proceeding?

The condyles of the femur were evidently enlarged, and the tibia was chiefly articulated with the under and posterior part of the external condyle. Nevertheless, by a careful examination, the leg being extended as much as the ankylosis would admit, it was satisfactorily ascertained that the patella was not adherent by osseous union to the femur, a slight motion upon its transverse axis being communicable to it; and as the joint was freely flexible to a greater extent, it was highly probable that no difficulty was offered by the bones and ligaments to further extension of the limb. It was presumed that, if the ligaments were so lax as to admit the joint to be easily flexed to its full natural extent, they would for this reason admit of the performance of extension, provided that other existing obstacles were removed. The only ligaments respecting which any doubt could exist were the lig. post. of Winslow and the posterior crucial; but as these were concluded to have undergone some disorganisation, or even elongation, to have admitted a partial luxation of the tibia backwards, they would be relaxed by the curative efforts, and rather facilitate the reduction of the limb, instead of being rendered tense, and thus opposing its extension. When a sudden effort was made with the hand to straighten the limb, a stop to the extension was perceived, almost in the same manner as if there were an osseous resistance in the joint: I at first feared that the patella, by its firm connexion to the outer condyle, offered the obstacle. But the forcible attempt to straighten the limb produced pain along those muscles on the back of the thigh which resisted motion in the intended direction; they were called into exercise and became rigid; but when after a few seconds they became exhausted, their organic contractility gradually yielded to the application of the superior power of the hands to the extent represented fig. 40. It was therefore evident, that the shortened state of the flexor muscles constituted the chief impediment, although the fasciæ and other soft parts surrounding the joint contributed their share to the contracture. That possessed by the contracted gastrocnemii in the maintenance of the partial

ankylosis of the knee, and the nature of their contraction, required much consideration. The contracted muscles of the calf formed a strong broad band, extending from behind the lower extremity of the femur to the os calcis, which were consequently approximated, and accompanied with flexion of the knee and extension of the foot. The application of pressure with the hand against the point of the foot served to a trifling extent to flex the ankle; but tended at the same time to increase the flexion of the knee; the gastrocnemii were, however, more elastic, the attempts to elongate them having been frustrated by a resistance somewhat less stubborn than that offered by the flexors of the knee, although whatever was gained by pressure for a few minutes was lost on removal of the hand. The explanation of the cause of the existence of so great a difference in the nature of the shortening of the gastrocnemii and the flexors of the thigh, is easy. Gradual contraction during a continued state of rest was the primary cause of the shortening in both sets of muscles, tending to produce organic or structural shortening. But a remarkable difference now existed; during the four years the disease had continued, the thigh-bone had grown to its proper length, thus greatly increasing the relative shortening of the flexors of the thigh; whereas the tibia and fibula were in a state of atrophy, not only in their diameter, but more particularly in their length; they were at least three inches shorter than the corresponding bones of the opposite limb; so that, although the same primary cause of the structural shortening of the gastrocnemii had existed, the bones of the leg having ceased to grow during the continuance of the disease in the knee, the contraction of the gastrocnemii was much less rigid than that of the biceps femoris, semi-membranosus, and semi-tendinosus. I was therefore of opinion, that no necessity would arise for division of the tendo Achillis, but that the gastrocnemii might be gradually elongated by an appropriate instrument, so as to bend the ankle, and enable the patient to place the heel upon the ground, and also that that portion of the bending

of the knee which depended on the contraction of the gastrocnemii would thus be removed.

The possibility of reproducing disease of the articulation, by performing an operation in its vicinity, and by a comparatively rapid extension of the limb disturbing the quiet state of the ligaments, required consideration. It was not, however, apparent that any danger of this nature existed, the disease having completely subsided two years previously, and the patient's general health, which was good (though rather delicate), had, according to the report of the gentlemen who had attended her, greatly improved since that period. To proceed with greater caution, I determined to conduct the requisite extension after the operation as slowly as possible; and should any unfavourable indications occur, symptoms threatening a renewal of the original disease in the knee, I resolved to suspend or altogether discontinue the extension. The only remaining question was, whether, should the operation prove successful and the knee become straightened, the patient would have a limb (the bones and muscles of the leg being shortened and wasted) sufficiently useful to repay for the pain and risk of the proceeding? I considered the most desirable termination of this case to be, that the patient should possess a bent ankle, a straight knee, and the power of moving both in every proper direction. That she would obtain the flexion of the ankle, little doubt could exist; it was most probable that the knee would be rendered straight, and that she would also obtain the power of naturally moving the ankle; but the restoration of useful motion of the knee-joint by voluntary muscular efforts was very improbable: the inadequate condition of the power of the flexors of the thigh required to be duly weighed; and a decision on the competency of the articular surface of the three bones of the knee to perform their natural office was impossible: the most important object was to straighten the knee, the accomplishment of which, even should it remain fixed in the straight position, would alone amply requite both patient and parent for the pain and trouble of an

operation succeeded by mechanical treatment. On this consideration alone I recommended the operation, considering that although the patient would for some time require the use of a stick, and the constant wearing of a shoe raised with cork, as some substitute for the diminished length of the bones of the leg, still a straight knee and leg, with the ankle restored to its natural motion, constituted a preferable alternative either to the necessity of performing locomotion on crutches, with the knee bent more acutely than a right angle, or to an amputation, which had been more than once proposed as the ultimatum.

Should the knee become extended and immovable in its new position, no difficulty could occur in bending it by the same mechanical means by which it had been extended; and if previously to becoming completely extended, much inconvenience, pain, and other disagreeable symptoms should arise, requiring the discontinuance of the extension, it was doubtful whether, considering the partial luxation of the head of the tibia backwards, the patient would not walk with greater comfort and less apparent lameness with the knee slightly bent than if it were absolutely straight.

Nov. 30, 1837. The operation was rapidly completed in the following manner, with the assistance of Mr. Complin, Mr. Hamilton, and Mr. Goss. The patient was placed with her face and abdomen upon a sofa, the point of the knee resting on a pillow, one assistant supporting the thigh, whilst another, with his hand on the back of the ankle, used the leg as a long lever to act upon the knee-joint, by which means the tendons were kept perfectly tense. The same precautions were observed as in division of tendons for the cure of Talipes, namely, with no more disturbance of contiguous parts or breach of surface than were absolutely necessary. The endeavour to obtain immediate reunion of the wound and postponement of extension until after its occurrence constituted the principles of the after-treatment; as by following an opposite course, through useless anxiety to ascertain whether the limb could be straightened, inflammation and suppuration might have been produced, and

the success of the case endangered. The knife employed for division of the tendons was a very narrow convex-edged scalpel, the point being introduced through the integument at the back of the articulation on the outside of the tendons of the semi-membranosus and semi-tendinosus muscles, with one of its flat surfaces directed towards these tendons; the point of the knife was carefully glided beneath them, its cutting edge was then turned upwards and directed against these tendons, by which immediate division was effected. The knife being withdrawn, the integument was stretched somewhat outwardly, so that the puncture by which the semi-membranosus and semi-tendinosus tendons had been divided was brought directly above, or rather to the outside, of the biceps tendon, which was perceived to be the only tendon undivided. A small curved bistoury was then introduced through the same puncture of the skin beneath the biceps tendon, which was instantly divided. The flow of a small quantity of arterial blood was arrested by slight compression with lint; adhesive plaster and bandage were applied. The patient was left quiet upon the sofa; she complained of pain in the divided part, and numbness of the skin behind the joint, as if some filament from the sciatic had been injured. In a quarter of an hour after taking tinct. opii. x.m_{ij}, she had ceased to complain. No fever or constitutional disturbance ensued; the wound united perfectly by adhesion; so that on the third day after the operation the apparatus for gradually extending the joint was applied. I had the satisfaction of perceiving the limb daily rendered more and more straight, without pain or sensation of resistance in the divided part or in the back of the thigh. The chief complaints were irksomeness, from having the limb constantly compressed by the straps of the apparatus, and pain in the front of the articulation whenever the extending screws of the apparatus* were turned. At the expiration of two months the knee was becoming nearly straight, and I considered that the time had arrived for

* The apparatus employed on this occasion is represented in Stromeyer's "Beiträge zur operativen Orthopädik," Hannover, 1838, Plate 5.

attending to the ankle (the extension of which, in a patient of less delicate health, might have been carried on simultaneously with that of the knee). It was commenced, but her health not having been improved by long confinement, added to the occurrence of neuralgia in the face, to which the patient had been subject, induced me to avoid subjecting her to much pain from the extension of the gastrocnemii, but rather to advance with the extension by insensible degrees. This determination was the more willingly induced as an elder sister had died of tubercular phthisis, and argument might not have stemmed the prejudices of affection had any serious deterioration of health ensued; for in a case of this nature the operation would be impugned as the cause of any subsequent misfortune, although the cure of a limb, by restoring the patient to the ability of taking air and exercise, would be one of the most certain impediments to the development of a strumous or consumptive tendency. No unpleasant event, however, occurred during the treatment except two slight epidermic excoriations; the ankle was restored to its natural state, the knee became nearly straight, the patient could voluntarily move the joint, and, with a sufficient substance of cork beneath the sole to compensate for the shortness of the tibia, was able, six months after the operation,* to walk with the assistance of a stick; it was believed that, as the muscles of both limbs, weakened by four years' inactivity, should acquire power, she would discontinue the use of the stick, and walk with considerable ease and freedom.

The time occupied by the treatment of this case, short as it was compared with the results obtained, might, with a patient whose health and age would enable the surgeon to advance uninterruptedly with the treatment, under ordinarily favourable circumstances, be considerably shortened —reduced, with safety and propriety, to six or eight weeks. In all such cases treated by operation, the adjuvant treatment of warm and steam baths, liniments, frictions, and

* This case has been already published in the "Cyclopædia of Surgery," Part III. July 1838.

manipulations should not be omitted, particularly after the extension by instruments has been accomplished, in order to obtain freedom of motion and prevent any tendency to recontraction of the restored limb. I have occasionally seen this patient since the above report. The progress was slow but constant; the extension of the foot having been continued until flexion to a right angle was obtained. She is able to dispense with the assistance of a stick when not taking exercise in the open air, and treads with increasing firmness. As on the approach of the leg to a straight position, greater irksomeness and inconvenience had been experienced from the extension, and as in consequence of the partial luxation of the tibia backwards, it was believed that the joint would afford greater security to the act of walking whilst slightly bent, than if rendered absolutely straight, it was considered advisable to discontinue the application of extension-apparatus, and remain satisfied with having so straightened the knee that the leg forms with the thigh an angle of about 160 degrees.

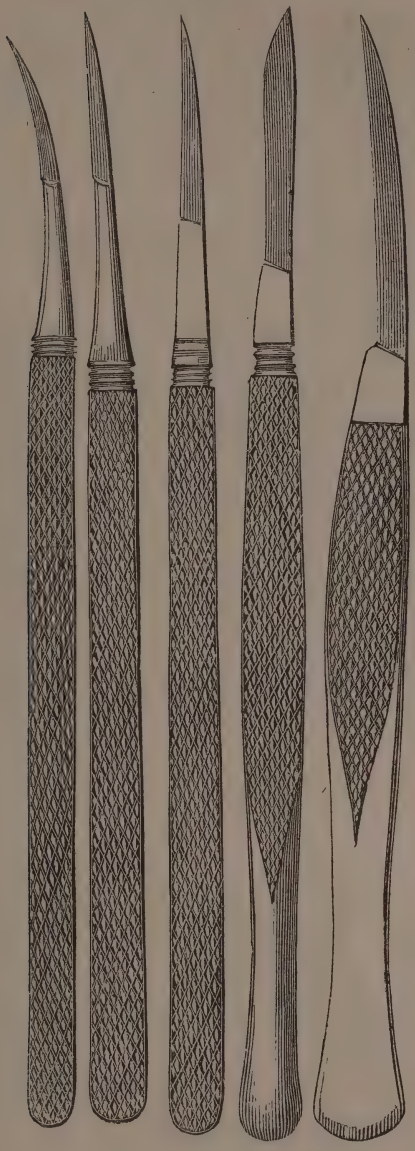


FIG. 41.—*Form and size of the knives which I have found convenient for division of tendons.*

No. 1.—A small, curved, sharp-pointed knife, for division of the tendo Achillis, but scarcely possessing sufficient strength for the operation in the

adult; it is also well adapted for division of tendons deeply seated, as those of the biceps femoris, semi-membranosus, and semi-tendinosus muscles.

No. 2.—A fine sharp-pointed knife, the edge of which is straight, adapted for section of tendo Achillis in children. After the operation, either with this knife or the preceding, the puncture in the integuments is seldom larger than one-twelfth or one-sixteenth of an inch.

No. 3.—A knife of a similar shape, but stronger and larger; it is equally adapted both for children and adults.

No. 4.—A small common scalpel, with which division of the tendo Achillis in adults can as readily be performed as with any other knife especially constructed for the operation.

No. 5.—A straight, sharp-pointed bistoury, the back of the blade possessing double the usual thickness, constructed for division by puncture of the tendon of the posterior tibial muscle:* the additional strength is necessary to preclude the possibility of the breaking off in the wound of any portion of it. I have frequently employed, for division of the tendo Achillis in adults, a knife of this form, but of the ordinary thickness.

* Whenever this tendon cannot be felt prominent, an incision of the length of about three quarters of an inch should be previously made.

The Apparatus described in this Work were manufactured by Mr. D. Ferguson, *Instrument-Maker to St. Bartholomew's Hospital, Giltspur Street.*

THE END.

LONDON:
PRINTED BY ROBSON, LEVEY, AND FRANKLYN,
46 St. Martin's Lane.

JUST PUBLISHED,

Handsomely printed in demy 8vo, price 10s. 6d. cloth boards,

FIRST PRINCIPLES

OF

MEDICINE.

BY

ARCHIBALD BILLING, M.D. A.M.

MEMBER OF THE SENATE OF THE UNIVERSITY OF LONDON,
FELLOW OF THE ROYAL COLLEGE OF PHYSICIANS, &c.;
FORMERLY PROFESSOR OF CLINICAL MEDICINE AND OF THE THEORY AND PRACTICE
IN THE SCHOOL OF MEDICINE OF THE LONDON HOSPITAL;
PRESIDENT OF THE HUNTERIAN SOCIETY;
VICE-PRESIDENT OF THE ROYAL MEDICAL AND CHIRURGICAL SOCIETY, &c.

THIRD EDITION,

CONSIDERABLY ENLARGED AND IMPROVED.

ADVERTISEMENT TO THE THIRD EDITION.

THOUGH it may be thought that the third edition of a book requires no advertisement, I consider it necessary to explain some circumstances connected with this work. Feeling that no author has been more indebted to the indulgence of the public press for kind criticism, I have endeavoured to profit by the hints given me in every respect but one. The first edition was sent forth to take its chance in the world without herald of preface or advertisement, unadorned by dedication, and unaccompanied by any table of contents: my reasons for the last omission remain unshaken. * * * * * * * *

"I found that the former editions were more pleasing to fully educated medical men and men of experience than to the tyro. This was not my original intention, and I have therefore taken pains to render the work more intelligible and useful to the latter, and have added much to suit the taste of both.

I do not think that I used too strong an expression formerly in speaking of the confusion which has existed in medicine; and as an example, need only refer to the striking fact noticed in this work, that the two words, *inflammation* and *irritation*, which are most frequently in the mouths of medical men, are up to this day perpetually used in a double or equivocal sense. Inflammation is correctly used to imply disease, and incorrectly to signify the process by which the damage done by the disease is repaired (see pp. 49, 51). Irritation is

perpetually incorrectly used to signify a state of disease, as it can only be correctly applied to the process whereby any thing irritates, annoys, or over-excites a part: the irritant, irritating thing, whatever that be, by its operation (irritation) produces in the part morbid sensibility. One great objection to using the term irritation to imply disease, is, that irritation (the act of irritating) produces sometimes inflammation, and sometimes only morbid sensibility; but, according to the old phraseology, *irritation* produces *irritation* and inflammation, and inflammation produces sympathetic irritation and constitutional irritation, and sympathetic irritation and constitutional irritation arise from local irritation, &c. &c. In order to avoid this equivoque, I determined, in the present edition, to adopt the term *morbid sensibility* as the name for the diseased state usually implied by irritation, and to use the word irritation only in its proper sense; and wherever the word irritation occurs in other works, implying disease, it will be found that morbid sensibility may be substituted for it.

In this alteration of a term, I consider that I have done the reader good service, rendering my own explanations more clear, and also those of other writers, by giving him an elucidation of the word irritation where it occurs as a disease in the valuable works of such authors as Sir A. Cooper, Travers, &c., and enabling him at a glance to distinguish whether if be mentioned as a cause or a symptom.

Many of the valuable works of Orfila, Christison, and others, on toxicology, will be more intelligible by referring to the state of morbid sensibility explained in the following pages.

Again, I have shewn (p. 67-68) that there is in reality no such thing as a specific; and, on the other hand, I have explained how some medicines become useful in such a variety of diseases as almost to realise the dreams of the ancients and alchymists respecting a *πανάκεια*, or an *elixir vitæ;* and why thus one empirical remedy, antimony, held the reins of the "currus triumphalis" until superseded by the more modern blue-bill. I may mention a few more of the explanations given. I have shewn that tonics are not stimulants; why they may be combined advantageously with sedatives, with stimulants, or with narcotics; how stimulants are tonic; how sedatives are tonic; how narcotics are tonic; and though not a homœopathist, how emetics stop vomiting, and purgatives diarrhœa. I have shewn how every medical man has his hobby to carry him to the same point, which, though he thinks it very different from his neighbour's, is as like it as one four-legged jade is to another; how one man thinks he has made a discovery that he can cure cholera with sugar of lead, and that there is nothing equal to it; whilst tartar-emetic, calomel, Epsom salts, or Glauber salts, or common salt, or mustard, or lemonade, or vinegar and water, &c. &c., will do the same thing; though none of them more quickly carry off the vomiting and purging than two of these hobbies in double harness—tartar-emetic, with some neutral salt, I care little which.

An anonymous writer once advanced against this work, that I differed from J. Hunter in the theory of inflammation,—as if he were "the law and the gospel." It may be seen that I differ not only from J. Hunter, but from his talented successors, Bichât, Sir A. Cooper, W. Lawrence, and others, in theory, on physiological and pathological principles, though little in therapeutics. On the subject of the division and classification of remedies, on the cause of the sounds of the heart, on the proximate cause of inflammation, on morbid sensibility, &c., I feel confident of obtaining the future suffrages of the profession. On the essential points of practice in the treatment of inflammation, I agree of course with men of such experience as Sir A. Cooper and Lawrence. It may be asked, then, what does it signify wherein we differ? It is, in my opinion, of great consequence to correct erroneous theories, and thereby enable students to arrive sooner at well-founded notions of practice.

Although this work consists rather of general pathology than what is called the practice of medicine, it will be found to contain the essentials of the treatment of disease. The greatest difficulties have arisen from the loose way in which remedies have been arranged and classified: I have endeavoured to remove these difficulties by the division into stimulants, sedatives, narcotics, and tonics; and by shewing how these are to be combined with each other, so as to afford a guide to clinical practice.

We sometimes find persons doubting the efficacy of valuable remedies from not knowing how to apply them; for instance, bark, sarsaparilla, dulcamara,

logwood, carbonate of iron, arsenic, conium, digitalis, elaterium, hydrocyanic acid, and blisters; each of these has at one time or other been said to be either inert or injurious, from misapplication, though they are powerful and efficacious remedies. We every day meet with old men who from prejudice have scarcely ever used some one or other of these substances; though others, placed in an extensive field of practice, such as our hospitals, use them daily with advantage: there are even persons who have been thirty or forty years in tolerably extensive practice who have not made use of a lancet so many times.

In going round the wards of an hospital, a pupil might remark to the physician at one bed, What a small dose, and at the very next, perhaps, What a large dose, you have given; large and small being both incorrect terms when the force applied is properly adapted to the quantity of disease and state of constitution. In practice there should be no such thing as boldness or timidity: boldness is an ignorance (for we must not suppose a recklessness) of the harm which too strong means may do a fellow-creature; and timidity is an ignorance of the efficient means which remedies afford of relieving human suffering.

In this edition I have added many cases in illustration of principles laid down, as they are equivalent to diagrams in geometry. A person who has studied geometry can understand the proof of a proposition in general terms without a diagram — but not so a beginner; and a beginner in medicine requires a reference to cases, to render some general principles intelligible.

CRITICAL NOTICES.

"That a third edition of this book should be now called for, considering that little more than twelve months have elapsed since the second edition appeared, is only what might be anticipated by those acquainted with its merits. The object of the author is to point out the necessity of deducing the treatment of diseases, as far as that can be done, from the ascertained and established laws of life, that is, from physiology. Without such a mode of proceeding, the practice of medicine must be neither more nor less than blind empiricism. 'Many persons,' says the author (p. 40), 'practise well empirically without much brains or reasoning; but he who begins upon principle, and then profits by experience, must be a much more skilful practitioner.' The remarks of our author (p. 50) on the great advantage of combining opium with antiphlogistic measures in the treatment of inflammation, or more correctly speaking, in supporting the system, after the necessary depletion has been employed, when the inflammation is subsiding or past, are excellent; they give the rationale of such treatment very satisfactorily. For the rationale of the treatment of acute and chronic inflammation by the metallic salts (mercury, antimony), and for valuable practical observations on this very important subject, we refer the reader to pp. 64-70. On the action and nature of stimulants, sedatives, and tonics, and their appropriate employment, see p. 74, &c. The great influence of the nervous system in the production of disease has been explained most lucidly. In illustrating the nature of morbid, and more especially of inflammatory action, our author has been peculiarly happy. In his illustrations he has taken good care to avail himself of the principal discoveries of modern science, more particularly with respect to the cerebro-spinal and ganglionic systems of nerves. In fact, we know of no book which contains, within the same space, so much valuable information, the result not of fanciful theory, nor of idle hypothesis, but of close, persevering clinical observation, accompanied with much soundness of judgment, and extraordinary clinical tact. He has evidently availed himself to the fullest extent of the splendid opportunities he has enjoyed for some years by the situation he holds of physician to the London Hospital, in which capacity, by the way, if we remember rightly, he was the first to introduce the custom of giving regular clinical instruction into the London School of Medicine. We shall terminate our brief notice of the work by earnestly recommending its attentive study to every class of medical students; nor do we think we should be going too far, were we to say that the practitioner will derive much important information and sound practical views of treatment from its perusal. Our advice is, 'Indocti discant, ament meminisse periti.'"—*Medico-Chirurgical Review.*

"We can imagine no more legitimate mode of producing a useful work than this; and Dr. Billing's opportunities of acquiring experience at the London Hospital, combined with the disposition manifested in these expressions [in Preface], entitle his observations to great attention. Nor are we unmindful of the debt of gratitude owing to Dr. Billing for being one of the first, if not the very first, to practise *clinical* teaching, in the true sense of the word, in the London school, so early as 1822. That Dr. Billing, an active as well as independent thinker, should find materials for half-a-dozen prefatory reclamations, does

in no degree so much surprise us as the good humour—little characteristic of reclamators—with which they are penned. Yet they comprehend important matters: the functions of nerves, the reflex principle, the theory of inflammation, the sounds of the heart, and the cholera; concerning all of which matters there has been much ink shed."—*British and Foreign Medical Review.*

"In wending through the hosts of too-often irrelative experiments, and the bewildering mazes of speculation, the author displays sound judgment and great power of discrimination; estimating each according to its worth, and associating with much skill those which throw the greatest light upon the important topic he has professed to treat. . . . . Persons who confine not their studies to the works of one sect or language, but retrospect and circumspect the physical sciences, medicine more especially, cannot fail to have been astonished at the very contradictory views and modes of practice which, at different times, and among different people, have been published, praised, and pursued; and still more must they have been astonished at the comparative similarity of effect resulting from such different treatment. . . . . What work, then, can be more useful than to reconcile the apparent discrepancies of contending theories, and to associate the practical advantages of the several schools into a common fund, or army, for future profit, or for future conquest? . . . . The views are liberal, and becoming a medical philosopher. . . . . We cannot pretend to abridge a treatise, in its construction almost aphoristical, so as to form a continuous essay; there will, of necessity, be frequent chasms between our extracts: to fill the void, we must refer to the mine whence they are drawn, rather as samples of what the industrious workman may there expect to meet with, than as proofs that the rich vein thus opened has been exhausted. . . . The observations on secretion and excretion, the growth and disappearance of tumors, &c. are well worth perusal: we only regret that space forbids us to do more than refer to them. . . . . The distinctions laid down between narcotics, stimulants, and sedatives, will be found of much practical utility to students. So many and so just are the practical remarks, rendered still more impressive by the terseness of the language in which they are couched, occurring in the latter, or more especially therapeutical part of the volume, that it would be difficult to select any one or two as samples of others."—*London Medical and Physical Journal.*

"The work of Dr. Billing is a lucid commentary upon the first principles of medicine, and comprises an interesting account of the received doctrines of physiology and pathology. We strongly recommend not only the perusal but the study of it to the student and young practitioner, and even to the ablest and most experienced, who will gain both information and knowledge from reading it."—*London Medical and Surgical Journal.*

"We have facts in abundance, but it requires the exercise of the highest order of intelligence to deduce from them the laws which govern, both in health and in disease, the wonderful machine called man. Several attempts, indeed, have been made to discover and apply these general principles, but the greater number of them have failed, partly because the corner-stone of the doctrine was nothing more than a mere hypothesis; and partly because of the obscure and mystified language in which the communications alluded to were wrapped up. From such reproaches the work now before us is entirely free. The language is throughout clear, simple, and divested, as far as the nature of the subject would permit, of technicalities, while the greater part of the general principles and doctrines inculcated by Dr. Billing is based on sound views of physiology and pathology. The nature of Dr. Billing's work is such as of necessity to place it beyond the reach of analysis; we are therefore compelled to confine our observations to a slight sketch, chiefly derived from remarks with which the author closes his account of the action of remedial agents. The first portion of the work is occupied by a consideration of the nature and treatment of inflammation. This latter state, which the author (in opposition to most writers, though, in our opinion, judiciously) regards as being *always* a diseased one, 'consists in a diminution of organic action in the capillaries, in consequence of which they become relaxed, and the blood is admitted in excess.' The proximate cause of this relaxation is a diminution of nervous influence, leaving the capillaries destitute, and thus permitting them to *yield* immediately to the ordinary injecting force of the heart. . . . Having explained the nature and cause of inflammation, Dr. Billing examines the various modes of action of antiphlogistic remedies, and points out, in a very clear and philosophical manner, the principles which should guide the practitioner in their application. Here the author, as he himself tells us, appears as a distinguished *solidist*, or advocate of *neuro-pathology*. . . . . We must refer our readers for a further insight into Dr. Billing's opinion with regard to the action of stimulants, sedatives, narcotics, and tonics, to the work itself; for it is impossible to comprise within our limits the general views which the author gives of therapeutics. . . . . We can strongly recommend Dr. Billing's 'Principles' as a code of instructions which should be constantly present to the mind of every well-informed and philosophical practitioner of medicine."—*Lancet.*

"The object of the work is highly praiseworthy. . . . . Dr. Billing has thus stepped forward and endeavoured to rescue the practice of medicine from the entanglements of systems, nosologies, classifications, and hair-breadth subdivisions. He regards disease at

large as having its joint and several manifestations through the medium of the sensorium acting on the minute capillaries, and assuming different phases according to the structure attacked, the predominance of vascular or of nervous excitement, and the greater or less intensity of the morbific poison or diseased action. He views life as a whole; and, without bewildering himself in the delusive phrases of 'life,' 'principle of life,' 'vitality,' &c., he investigates the particular vital functions of particular organs, attributes to them their particular vital endowments, and surveys them as they perform or falter in their allotted parts under the vital control of the governing organ of the body—the brain and spinal marrow, with its (mysterious) companion, the ganglionic system. A summary of all that is known and received as true concerning motion, sensation, and organic function, in obedience to the great sympathetic, the medulla spinalis, and the sensorium, is related (pp. 108-116) with the brevity and perspicuity of one who is master of the subject. We have read works of physiology which thus treat of these organs and their functions; but it is only of late that we have perused books on practical medicine which have treated these functions in this manner; and very few, if any, have so successfully applied them to clinical subjects as the present author. . . . . If the work have no other merits than this, it will have quite enough to claim the attention of the student—namely, the care with which the functions of the nervous centres have been studied and explained, and, above all, their immediate application to pathology and bedside practice. Indeed, it is the leading virtue of the author never to lose sight of the bedside; and the numerous points of treatment in regard to the exhibition of remedies, distributed throughout the work from the first page to the last, would, if extracted, alone form a catalogue worthy of being committed to memory. We again revert to the pathological observations on the nervous system, without an accurate and comprehensive knowledge of which the right treatment of paraplegia, tetanus, hydrophobia, neuralgia, and the extensive family of neuroses, must for ever remain vague and indefinite, obscured by the still more indefinite and vague terms of 'nervousness,' 'nervous irritability,' 'asthenia,' 'debility,' &c. which are nothing more than the masks of ignorance. We should be ungrateful to any gentleman who has made such advances into a field of inquiry so unknown and so extensive as that of the nervous system, if we did not acknowledge our obligations for what has been produced, as affording to the practitioner more clear and enlarged conceptions of disease, and in all probability lending a seasonable aid to a more full recognition of the particular laws of life at the bedside."—*London Medical Gazette.*

"The quick demand which has been made for a third edition of this work, and the highly eulogistic tone with which it has been received by the medical critics, naturally entitles it to somewhat of extra-professional notice, more especially as for the same causes it will doubtless attract the attention of many extra-professional readers. As Dr. Billing wrote for his juniors, to initiate them into their future studies, his style is exceedingly simple and clear, describing the various diseases of the human system, distinguishing one from the other, and prescribing their remedies with equal perspicuity and intelligent illustration. To him belongs the singular honour of having been the first clinical lecturer in the metropolitan hospitals; and in the contents of this volume we can fancy we discover the manner of a truly sagacious physician, pointing out to his pupils, at the sick man's bedside, the nature and progress of disease, and the principles upon which it is combated by medicine. It is this unaffectedness of address, if we may use the expression, and absence of pedantry, that gives this work a positive charm to the laic reader, even as the intelligent of all classes relish the classic pages of Blackstone, in which the young lawyer finds his best elementary instructor. There are few books in which the *non multa sed multum* maxim is so well illustrated as this of Dr. Billing, and we doubt if a moderate-sized octavo volume could be produced containing more substantial matter. This power of condensation has not escaped the notice of one of the doctor's German commentators. Amongst the various interesting matter in this book, the reader will be struck by the importance ascribed by Dr. Billing to the use of the stethoscope, for which he considers the medical profession under infinite obligations to Laennec. In his own use of this simple but effective instrument he made the discovery of the *sounds* of the heart, and traced them to their true causes, which he succinctly stated in these words:—'The first sound is caused by the tension produced in the shutting of the auriculo-ventricular valves, and the second by the tension produced in the shutting of the ventriculo-arterial valves.' The originality, as well as correctness of this curious and important discovery have had their controverters; but in both respects there is now, we believe, but one opinion, and that wholly to the credit of Dr. Billing. It is, however, in regard to that native plague of our climate, tubercular consumption, that the utility of the stethoscope appears, in the doctor's estimate, to most advantage, not merely in enabling the physician to know the state of the disease where it actually exists, but what is perhaps equally important, to distinguish from it other affections of the 'viscera in the chest,' which might otherwise create unnecessary alarm, besides being subjected to improper treatment. Some striking cases are stated in illustration of this point. In all that relates to the subject of consumption, Dr. Billing's opinions seem to be marked with strong good sense; and we are not surprised to find him protesting emphatically against the practice of sending 'patients away from their friends, and often

at an enormous inconvenience. If they are consumptive,' he observes, 'they will thus die in exile; if not, they may be cured at home.' A portion of this work is, of course, dedicated to the subject of cholera, and it is of the deepest interest, containing what we believe to be the original views of Dr. Billing—that this 'dire disease' is 'essentially febrile, whether it assume the intermittent, remittent, or continued form—that it is not a new disease, but the same described by Sydenham in 1669, and subsequently by Frank,' &c., modified, to use the words of Sydenham, according to the 'constitution of the epidemic in the year in which it occurs.' This, however, is a question for the gentlemen of the gold-headed cane. Having, as we have stated, the high opinion of the profession in favour of the soundness of the opinions set forth in this work, and feeling for ourselves how strongly, both from its subject-matter and style, it can excite the interest of the non-medical reader, we cannot lay it down without the impression that a better volume could not be chosen to fulfil the purpose of Locke, when he recommends as a portion of a liberal education a general acquaintance, not only with anatomy, but the principles of medicine."—*Morning Herald.*

"It is pleasant to read, and profitable to study, a book like this, abounding in the condensed thoughts of an acute mind long and laboriously employed in a long and diversified field of operation. It is evident that Dr. Billing has omitted no opportunity of reaping the harvest from the field which he had skilfully and sedulously cultivated—that he has not failed to deduce from his clinical observation such results as a sound, sober, philosophical mode of thinking seemed to him to justify; and in the main we are bound to say that he has, in our opinion, arrived at right results. He has touched and briefly illustrated an immense number of important subjects, in physiology and pathology, theory and practice; he could not, nor was it his object to discuss them at large. His chief purpose was to establish right principles in the application of remedies, based on the constant relations subsisting between structure and function, and the manner in which certain agents affecting the body suspend function or subvert structure; knowing that, without the guidance of true principles, the practice of medicine must be work done in the dark; if right, right only by accident, and therefore always dangerous, often destructive. It would be impossible to give any analysis of a work so purely analytical, without writing as much as the author; we must therefore limit ourselves to expressing our high opinion of the whole, pointing out, by way of specimen, the distinctive qualities and appropriate uses of the remedies to which writers on materia medica have given the names of stimulants, sedatives, narcotics, and tonics, as they are clearly, and with a view to healing practice, exhibited by Dr. Billing."—*Weekly True Sun.*

"We hail with considerable satisfaction the appearance of a new edition of Dr. Billing's valuable treatise on the 'Principles of Medicine.' Among medical practitioners we recognise two classes; one who might properly be called empyrics (using this term in its old signification), and the other, men who in their treatment of disease act upon acknowledged and well-defined principles. The former class base their practice solely on experience, without understanding the pathology of the disease, or the *modus operandi* of the agents they employ for its removal. The latter class of practitioners, whilst they pay a proper respect to past experience and cases which may have come under their observation, still act, in every case, on the principles of physiology and pathology, being able to describe minutely, except in anomalous cases, the nature of the organic change which is the consequence of diseased action, and the operation of the remedies which they exhibit. That the physician whose practice is founded on a knowledge of the principles of medical science, is far superior to the man of mere facts and experience, will be readily admitted by every person capable of reflecting upon the subject. In Dr. Billing's work we find contained every thing which a medical man requires to know of the principles of his profession. It is full of the most valuable facts, from which he draws all his deductions. The first part of the treatise embodies a graphic view of the anatomy and physiology of the human body. He then proceeds to the subject of inflammation; and this portion of the work is replete with valuable information. Indeed, looking at the book as a whole, it constitutes one of the most important dissertations on medical science to be found in the English language. Dr. Billing is evidently a man of considerable experience, of great powers of reasoning, and possessing a profound knowledge of every department of the science of medicine. This experience, judgment, and knowledge have been brought to bear in the composition of the work which is now before us; and most cordially and seriously do we recommend its attentive perusal, not only to medical students, but to advanced practitioners; feeling convinced that it will give them a correct notion of the philosophy of disease, and instil into their minds principles which they will find of essential assistance when summoned to the bedside of a patient. Again we say to every medical man, Make yourself acquainted with Dr. Billing's philosophic treatise on the Principles of Medicine."—*Surrey and Middlesex Standard.*

"Dr. Billing enters very largely into an examination of the symptoms indicative of the various diseases to which the human frame is internally liable, more especially those which affect the heart. The non-professional reader will find in it a mass of most useful

information conveyed in the plainest language; and such a reader will readily unite with us in pronouncing the absence of professional technicalities in a medical work no slight merit."—*Sun.*

"Amongst the numerous points essential to a just criticism, in medical works especially, one of the first is, that the critic should have read all that has ever been written on the subject, and understand it perfectly. We flatter ourselves that few of the works written on medical science from the time of the revered Hippocrates, who first made it a separate branch of study; of Socrates, who discovered the use of anatomy in illustrating the principles of natural theology (afterwards followed up by the eloquent author, 'De Natura Deorum'); of Plato, who named the blood the pasture of the flesh, running through the body in numerous rivulets, like a garden well stocked with canals, and carrying the vital moisture from the heart;—from these, through a long line to the days of Harvey, Jenner, Laennec, and Andral, few of this host have escaped us. The knowledge derived in this manner has enabled us to separate, in most instances, the true metal from the dross that is daily scattered around; and in the work before us this task has been peculiarly easy, from its great and prominent worth. Few, indeed, of the medical works daily issuing from the press can be spoken of in similar terms; and we are happy to say, in regard to this one, that it has met with almost universal approbation. It is written by a gentleman who has long and honourably held a high rank as professor of clinical medicine at the London Hospital, where he has received the warmest praise from thousands of students who have ardently followed his lectures. It was he who first, in London, commenced the important work of clinical instruction; and by the attentive treatment of patients, together with the frequent examination of post-mortem appearances, explained to his students, as far as human means are available, the progress and termination of disease. The opportunities afforded in this extensive hospital have been diligently seized by Dr. Billing, and the 'Principles of Medicine' are the result of his labours. What can we say more of a work than that it contains the most valuable and original ideas in every page, clothed in language remarkable for its elegance and perspicuity? Where the treasures are so abundant the task of selection is proportionably difficult; but we may safely affirm that the whole is a work of unequalled excellence, establishing Dr. Billing as one of the most eminent men of the present day. It may truly be said that originality is the most common want amongst our medical authors. Few do more than dress their hobby in a new suit, and with a washed face thrust it forth to the multitude. The work before us is an interesting exposition of the modern doctrines of physiology and pathology, written for the student of medicine and the practitioner, but which may be perused by the unprofessional with the greatest profit. . . . . The above extracts give but a meagre idea of Dr. Billing's work. In fact, it requires to be studied attentively; and all we desire is to direct attention to it as a truly philosophical production—the result of years of experience and successful study. In the practical portions, or in those in which he gives his own treatment of cases occurring in practice, we trace the mind of an accomplished physician; and although not like the man in Moliere, who wished to be ill that the powers of medicine might be displayed in his person, yet should we unfortunately lose our wonted vigour, we know of none to whom we would sooner apply for assistance."—*Torch.*

"The third edition of Dr. Billing's 'First Principles of Medicine,' is a very able and valuable work; the fruit, as all scientific works ought to be, of the thoughts and inquiries of many years steadily directed to one subject. . . . . As an example of Dr. Billing, we will give an outline of his theory of that important subject inflammation. The generally received opinion is, that inflammation arises from *increased arterial action;* but the Doctor shews there is *no* action but what is imparted by the heart. So far from increased arterial action being the cause of inflammation, it is in reality the means or symptom of its cure."—*Spectator.*

"The profession and the public owe an additional debt of gratitude to Dr. Billing for his valuable work, the present edition of which is enlarged to twice its former size and importance. Dr. Billing, it must be remembered, was the first to introduce clinical lectures, to insist on the importance and promote the practice of clinical teaching in our medical schools, reducing, as far as it was practicable, the science of the healing art to general principles. His long connexion with the London Hospital, and arduous duties there, gave him ample and extensive opportunities for acquiring that solid experience which, guided by a correct judgment, has enabled him so largely to contribute towards the alleviation of the various maladies incident to our nature. We have not space to advert to the many admirable principles laid down by Dr. Billing in the work under notice; we must, however, observe, that they are ably, lucidly, and, what we consider a great merit in books of instruction, plainly written. A summary of all that is known and received as true concerning motion, sensation, and organic function, in obedience to the great sympathetic, the medulla spinalis, and the sensorium, are related with the brevity and perspicuity of one who is master of the subject. We have read works of physiology, which thus treat of these organs and their functions; but it is only of late that we have perused books on practical medicine which have treated these functions in this manner; and very

few, if any, have so successfully applied them to clinical subjects as the present author." —*Bell's Weekly Messenger.*

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